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Editorial Notes.

"The Governor."

OLYMPIA has been the scene of many remarkable displays; but never one more remarkable or significant than that witnessed there last Saturday evening. Assembled were 12,000 workers of the Gas Light and Coke Company; and they were there to do honour to one man—"The Governor," Sir David Milne-Watson, LL.D., D.L. The knighthood which was conferred upon him by His Majesty the King has been a matter of pride and rejoicing among the employees; but they wished to supplement their known loyalty and appreciation of him as a man and as head of the concern which gives them employment by some tangible presentation which, by its very existence, would convey to those who came after the message of how the co-partners of the Company in these times regarded their supreme chief, who worked so zealously and successfully for the establishment, in mind and with material effect, of that community of interest which is the safest rock upon which any industrial concern can stand. And so an idea of the Co-partnership Committee was swiftly and enthusiastically taken up throughout the ranks of the Company's workers; and upwards of 13,000 co-partners provided a fund which enabled the initiators of the scheme to commission that great master among artists—Sir William Orpen, K.B.E., R.A.—to paint a portrait of Sir David. It was to hand to him the oil painting, and to Lady Milne-Watson a silver Georgian tea service made (in Sir David's native city of Edinburgh) in the same year that Murdoch first lit his house with gas, that the large army of employees of whom the Governor is so proud lined the seating accommodation of the vast area at Olympia. No other building in London could have supplied the accommodation for those who desired, and were able through release from their duties, to be present. They flowed to the one centre from all quarters of the vast district supplied by the largest gas undertaking in the world; they represented all grades of workers and occupations; and no doubt also a mass of heterogeneous opinion on many subjects save specially the object for which they were met together as members of one superb and mighty industrial machine. Their enthusiasm knew no bounds; for men admire a leader who by acts and deeds has proved himself to be genuinely such. And the men of the Gas Light Company know, and are proud to know, that their Governor has worked not only for the stability of their Company, but for that of the whole industry, and has thus won for himself in the estimation of his administrative peers a place that has no comparison in the long history of the industry. We will not enlarge here upon the speeches, in making the presentation, of Mr. R. W. Foot, the Assistant General Manager, and Mr. W. S. Edmonds, one of the employees at the Bow Common Works, and the oldest member of the Co-partnership Committee, nor upon the feeling acknowledgment by Sir David. Our verbatim report of the addresses made on this remarkable occasion will show the depth of sincerity and reality that there was in the whole event. Goodwill and confidence moved throughout Olympia; and it was all a living witness to the fact that large as the concern has grown, extensive as is the number of employees, ways and means have been found for keeping in existence those personal and human relationships which it has been said ceased in industry and commerce with the coming of joint-stock concerns. The negation of this is found in the act which was consummated by presentation on this memorable Saturday evening. The portrait and the story of how it came to be painted will carry deep down into the years, for future administrators, executive officers, and workers alike, the great truth that the belief of these days in the Company is that the one and only way for success in such an enterprise is mutual consideration, help, and interest.

Absolute Supervision by the Treasurer's Department at Blackburn.

IT is some years since the organization which is devoted to the interests of municipal treasurers adopted as a policy the principle that supreme control of all the finance of a local authority should be centred in their department, including municipal trading undertakings, which, if they are to realize maximum success, must have the same liberty in financial transactions as applies to private enterprise. It is impossible to tether a commercial concern by a short length of rope (to which conditions are applied) to the Borough Treasurer, who (as probably his Committee) knows as much as the man in the moon about the legitimate requirements of a trading undertaking, and to expect it to function with the same mobility and advantage as a business that is not similarly handicapped. The Blackburn Town Council have, in the face of an opposition which knows the danger of making more complex their financial movements, passed a resolution, adopting some new standing orders which virtually make the Borough Treasurer the supervisor of all expenditure of the trading departments.

It seems to us the Council have fallen a victim to a reactionary policy which creates a new entanglement, without taking the trouble to ensure that it is really necessary; and, to say the least, the manner in which it has been done is not complimentary to the trading departments, or to those who have worked diligently for success, as in the case of the Gas Department. The procedure has been somewhat autocratic. There was no preliminary official consultation with the departments or responsible

officials regarding the standing orders. It would have been courteous to have taken counsel with them; to have heard whether or not, with their large experience of the administration of their concerns, there were genuine objections to the proposals. Nothing of the kind entered the minds of the promoters of the change, or, if it did, it was not acted upon. Their attitude in the matter has been that of absolute authority, and not that which recognizes the efficacy of collaboration and investigation with those who know. In the genesis and fabrication of the new rules, it has all been one-sided; and the big trading undertakings have simply been treated as though they are of no account, and should have no voice in a change of policy. More than one member at the meeting where the standing orders were adopted said, in effect: "It is "for the Council to decide; and it is for the officials and "committees of the trading departments to comply with "those decisions, or get out." Such a want of politeness and diplomacy, if the smooth working of all parts of the borough machinery is desired, does not appeal to us as being correct. The whole procedure simply scouts the experience and ability which, at any rate in the Gas Department, has done so much for the borough. It is all little short of an insult. And the outside observer who is competent to judge in these matters wonders why the Council have thought fit to make a change to something which has not obtained during the years of the great prosperity of the gas undertaking. It looks as though they are deliberately putting a spoke into the wheels of its prosperity by altering the normal course of working.

In the new standing orders we find that any work or article the cost of which exceeds £100 is to be the subject of a resolution, which shall specify the work or purchase and the maximum amount authorized. A requisition book is to be provided, and each requisition therein, if approved, is to be signed by the Chairman. This is the first piece of cumbrous procedure which has been adopted, and thought applicable to a large trading undertaking. In the eyes of our great industrial magnates, the application of such conditions to a substantial trading concern would be regarded as the height of folly—exemplifying a desire to clog, and an absence of confidence in, the administration of the concern. The effect can be only to curb and to cripple. But stay! Heads of departments may in cases of emergency, and when delay may in their judgment be injurious to the service, order such articles to be supplied, or work to be done, as may be necessary; but they are to report it in the requisition book for approval at the next meeting. We can see there scope for much disputation in future. What the head of a department may consider is "a case of emergency" may not be the view of members of the Council; and his judgment as to delay being injurious to the service may be the subject of disagreement on the part of others. There is an unpleasant littleness about the whole business. The heads of trading departments will always be on thorns as to whether or not, within the meaning of the regulations, they are doing right. We can quite conceive occasions in which, for instance, the Gas Manager will not be able to carry on his undertaking with the same success as hitherto. In the case of a trading undertaking, a decision regarding a purchase has often to be made promptly, or an opportunity be lost. The manager may have a chance, by quick acceptance, of making a bargain, which would be financially beneficial to his concern. He would not be able to call this an "emergency." But if he does not clinch the bargain, he will be producing a loss for the Corporation and the ratepayers. Only the other day, the Glasgow City Council gave their Gas Manager power, instead of entering into contracts, to buy as opportunity arises all the coal required in the current municipal year for the gas undertaking. The Blackburn Town Council have solemnly declared that the executive head of their undertaking may not spend more than £100 save in a case of emergency, or if he is satisfied there would be injury to the service! The zeal for guardianship has produced administrative myopy, and failure to see effects beyond. Then in the case of capital, before any committee directing a trading undertaking dare to spend capital, they are to communicate their resolutions to the Finance Committee; and no proposition involving capital expenditure is to be laid before the Council until it is considered by the Finance Committee. In short, nothing is to be done involving expenditure without information is given to the Borough Treasurer. We sympathize with trading undertakings that have to work under such red-tape conditions and hindrances.

It was admitted by Alderman Fielding, who submitted the new standing orders for adoption by the Council, that they might be awkward for a little time. We submit they will be awkward for all time that they are in being. We agree with those councillors who are of opinion that the Borough Treasurer has been made (so to speak) General Manager of the Corporation, including the trading departments, and that this has removed from the latter that elasticity which is so essential to success. It is ridiculous to suggest that the Borough Treasurer is only to act in the matter as an Auditor. The negation is found in the terms of the new standing orders. What the Council have done is to introduce something which cannot make for harmony and the smooth working of the mechanism of the municipal system.

Coal and Coke Handling Plants.

The important place that coal and coke handling plants have in the gas-works system of to-day, and the severity of the work which they have to perform, necessitate that every possible provision shall be made to secure the maximum efficiency, combined with economy in working and upkeep. The makers of such plants will find from the paper of Mr. W. L. Robertshaw, of Sunderland, which he presented to the North of England Gas Managers' Association on May 4 (as reproduced in this issue), that in him they have a studious critic who very properly is out for securing the maximum duty for the lowest outlay from plants of the description referred to. He says the design of coal and coke handling plants has, with some exceptions, been left mostly in the hands of contractors. But the whole paper supplies the evidence that it would have been better if, in the design of some of the plants, the skill of makers and the experience of gas engineers had been more effectively combined in order to produce greater ultimate efficiency and economy. Respecting most of the plants dealt with in the paper, there are criticisms as to deficiencies in design. It is indicated that competition in price is usually the ruling factor of design. For any plant which has to work under such drastic conditions, competition in price as the ruling factor is a great mistake. It can only result in the degradation of the plant, and produce deficiencies in service or inconveniences for the making of renewals and maintenance. Design of a plant of the kind should have regard more to life, ease of maintenance, and efficient service than to the single factor of initial cost. It is not a question of the lowest price to do a given amount of work; it is a question of what the price is going to return in the way of operating results, and in respect of facility for examination, lubrication, and maintenance. Thus it is that Mr. Robertshaw says: "I am of the opinion that too much time "cannot be spent in studying the detailed drawings, "especially with regard to the arrangement of all parts "for easy access and renewals, lubrication, &c., as only "those who have had experience of troublesome coal and "coke handling plants know the amount of worry they "involve."

Part by part coal and coke handling plants are examined by the author, and defects and requirements are set out. He takes the coal-breaker; and, alluding to one kind which is much used in gas-works, he finds that it has no provision for easy renewals or repairs, and, before any roll shaft can be withdrawn, the whole of the gearing which operates the rolls has to be removed and the structure dismantled, which, of course, should be unnecessary, and is an expensive operation. His ideal of a design for a breaker is that it should allow of the removal of all vital working parts without undue interference with the structure. He urges the provision of safety devices to prevent damage being done to the breaker; and there will be general agreement that all claws and gear wheels on the main breaker shafts should be of steel. The efficient greasing of the breaker bearings is a point which has engaged his attention; and he shows an arrangement which has been a complete success. A very interesting

section of the paper is where Mr. Robertshaw deals with coal elevators, from the point of view that they should be designed and worked in a manner which will result in savings of operating, wear-and-tear, and labour costs, which, in the aggregate, may amount to a large sum. Naturally, elevators working with the buckets barely half filled are not performing the work economically. If more coal can be lifted while running at the same speed, it should be done rather than increase the speed of running so as to attain the same end. In this connection, the author instances a case in which an elevator was constantly getting blocked, and was only doing, at its best, about 60 p.ct. of the work of which it should have been capable. He considered various remedies, and eventually decided to fix 47 additional buckets to the elevator, which already possessed 94, one attached to every third link at 1 ft. 6 in. centres. The extra buckets made one bucket on every alternate link, thereby reducing the centres to 1 ft. The result was that the delivering capacity of the elevator was increased by 50 p.ct., though still running at the same velocity. To have raised the duty of the elevator so that it does in 5 hours the work which previously took 7½ to 8 hours is highly beneficial in works economy. Prior to the change being made, it was seldom that more than 14 tons of coal were delivered per hour into the overhead hoppers; but since, the delivery has amounted to 22 tons, and often more.

The next section of the paper deals with the handling of coke, which is about as unfriendly to the plant which handles it as it is possible for any material to be. It is a sound principle to follow in the design of such plants that the fewer the working parts the better; but all parts should be easily accessible and renewable under normal working conditions, and with the least possible inconvenience. This especially applies to works of medium size where there are not a number of retort-houses, each of which can be let down at different times to enable overhaul and repair work to be done. Mr. Robertshaw shows how he ingeniously carried out extensive repairs to a hot coke conveyor without seriously disorganizing the normal work of the retort-house. The table giving the life record of hot conveyor chains will be examined by many engineers with interest. It will be seen that the best record so far has been made by the original chain, which handled 52,400 tons of coke and breeze, at a cost per ton of 0·91d. Shorter life succeeds for the renewal chains, although the total costs of the chains have increased, and the cost per ton has also risen. But it looks as though the sixth or last replacement chain, which to April 30 had handled 42,100 tons of coke, is likely to deal with not less than 50,000 tons before it requires replacement, and that is the cheapest chain in the last four replacements. Towards the end of the paper, a description is given of a Morris electric transporter plant, which has been erected primarily for lifting coke to the railway sidings, which are some 50 ft. above the works yard level. This transporter has proved a great economy for this particular purpose; and the varied service of which it is capable has rendered it an indispensable part of the equipment of the works. It is used for loading spent oxide into trucks, hoisting retort material, lifting coke to overhead hoppers, supplying the producers of the coal-gas plant and the generator of the water-gas plant; it transported coal during the coal strike from store to the ferro-concrete receiving hopper above the coal breaking machinery, and it lowers to the yard level goods received by rail. In the event of the coal-elevator breaking down, the transporter can be used for removing coal from the store into the overhead hoppers above the retorts. The whole cost of the transporting scheme was £1400; and a detailed table of the costs of coal loading on a 90 tons per day basis shows a total per ton of 13·31d. The direct savings which the plant has effected mean that it has paid for itself in less than three years.

Mr. Robertshaw's paper will have interest for all gas engineers using coal and coke handling plant, or who are contemplating such use. We are also confident that it will induce many engineers who have not made a point of examining their plants to ascertain whether they are giving of their best in working efficiency and cost economy, to do so with a view to realizing the gains which the author shows are within reach of those who seek and work for them.

Sulphate Effluent and Sewage Plants.

STAFFORD is making good contribution to the solution of the problem of how to deal, in conjunction with sewage plant, with the sulphate of ammonia effluent from gas-works. We ascertain this from a paper that Mr. W. Plant, Assoc.M.Inst.C.E., the Borough and Water-Works Engineer of Stafford, read on April 28 before the Institution of Municipal and County Engineers; and the information he imparts is highly encouraging. It is obvious that the author has given close and patient investigation to this matter; and the fact that a demonstration plant has developed into a scheme now under construction to deal with the whole of the borough sewage and the liquor from the gas-works is sufficient guarantee of his satisfaction. The activated sludge system (diffused air principle) was adopted for trial; and it is the one on which the complete plant is being laid down. The demonstration plant consists of the aeration tank, reactivation tank, and settlement tank. It has been dealing with one-sixth of the total flow of sewage containing the spent liquor from the gas-works sulphate of ammonia plant. For over two years this has produced a fairly stable effluent, notwithstanding the fact that the sewage has had no preliminary treatment beyond passing through coarse screens. The objects of the investigation were to ascertain the effect of the spent liquor on the process, the relative capacity of the tanks required to treat the sewage with and without gas liquor, and the total capacity of the plant necessary to deal with the whole flow of sewage mixed with the gas liquor. A regulated flow of gas liquor is necessary; and before the plant was brought into operation, a balancing-tank, capable of holding 120,000 gallons of spent liquor, was put down at the gas-works in which to store a portion of the liquor when the sulphate plant was at work, and from which it could be pumped later at a predetermined rate when the plant was at rest.

The experience showed that six similar units were required to treat satisfactorily the whole of the sewage mixed with gas liquor (four would have sufficed without the liquor); and so six have been adopted in the complete scheme. Another finding was that the quantity of air needed to purify completely the mixed sewage and gas liquor without preliminary treatment was 2½ c.ft. per hour. The four-hour oxygen absorption figure for Stafford sewage, mixed with an even flow of gas liquor, averages about 11·5 parts per 100,000; and the corresponding figure for the final effluent from the activated sludge unit is about 1·2. With the introduction of detritus tanks, it is expected that the initial figure will be reduced to about 8·5 parts per 100,000, so that an improvement in the final figure, or a reduction in the volume of air, may be looked for. Of course, the quantity of spent liquor from the sulphate plant varies considerably; but the average quantity passing into the sewers may be taken to be about 200 gallons per hour, or about half of 1 p.ct. of the total volume of sewage. The strength of the liquor is also very variable. The four-hour oxygen absorption figure (average over numerous samples) is 750 parts per 100,000—individual samples varying from 450 parts to 1500 parts per 100,000. The author gives the running costs for the demonstration unit; but these, he is careful to point out, are misleading. The labour costs account for more than half the total; and, owing to the small size of the unit, the labour is not economically employed. Including labour charges, oil and current at 1d. per unit, but exclusive of capital charges and depreciation, the cost of dealing with sewage and gas liquor combined (with the one unit) works out at about £9 per million gallons treated, as against £7 15s. for the million gallons of sewage alone. With the complete plant and preliminary settlement, larger and more efficient air compressors, and labour used to much greater advantage, the running costs obviously will be substantially reduced. Mr. Plant's estimate is that the average cost of dealing with the whole of the sewage and gas liquor will be in the neighbourhood of £5 10s. per million gallons. This is eminently satisfactory. Stafford is making an excellent contribution to the solution of a most difficult problem.

In later columns we reproduce the section of the paper which gives the details of the plant and other matters to which we have here briefly drawn attention.

Industrial Load Development.

Among the District Conferences of the "B.C.G.A.," that held at Redditch last Wednesday will be voted to have been one of the most stimulating on record in respect of the development of the industrial load by medium sized and small gas undertakings. The Redditch Gas Company have done well in this direction. Last year their business with the industries of the town represented no less than 40·3 p.ct. of the gas sales. This is not surprising with such an enterprising directorate, headed by Mr. Leslie E. Clift, as the Company possess, and the energy which Mr. C. F. W. Rendle brings to bear upon the development of the interests of the undertaking. Co-operative ideals are strong there. Administration and management believe in co-operation not only within the industry, but between a gas undertaking and its customers; and therefore between the local industries and the suppliers of gaseous fuel. The Chairman of the Birmingham Corporation Gas Committee (Alderman J. H. Lloyd) made the point at the luncheon that manufacturers are only now realizing how much they have to gain by co-operation with gas undertakings in the review and revision of their heating processes; and he speaks with the extensive knowledge that has been gained, through the Industrial Research Laboratories of the Birmingham Gas Department, of how much there is to be, and can be, done to the mutual benefit of manufacturers and gas undertakings. The influence of those laboratories has spread far and wide in the Midlands—much beyond the city boundaries into the areas of other gas undertakings. The co-operative spirit is actively at work there; and Mr. Rendle acknowledged with gratitude the substantial help his Company and his industrial customers have received from the Birmingham laboratories.

A paper was presented by Mr. H. R. Hems which carries us deeper into this question of collaboration between industries and gas; and which submits certain constructive suggestions for developing the standard load. But the start in this matter must be made by the gas undertakings themselves. It was pointed out, during the discussion, by Dr. C. M. Walter that one of the revelations of Mr. Hems' paper is the number of unexpected processes to which gas has been successfully applied. But the unearthing of these had to be done by individual investigation. That initially there must be individual investigation to provide a starting-place is a lesson that is fundamental to the development of the industrial gas business. It is, however, a lesson that has not yet been learned by all gas administrators in this country. Then there are many obstacles to be overcome before in some cases conviction can be secured that there is a gain in the application of gas and its refined methods in place of other fuels and their attendant relative crudeness of method. As Mr. Hems says, the disposition continues on the part of manufacturers, in discussing heat treatment methods, to consider fuel costs alone; and the difficulty is to get them to take into reckoning the economies and efficiencies which follow in the train of the change to gaseous fuel. When one fuel is productive of economies not obtained by another fuel, then it should have them placed to its credit in assessing its value to the user, and against the old fuel the differences—the losses—of economy should be debited. Hence it is that Mr. Hems urges the importance of records of fuel costs being kept, and that they should be considered conjointly with other important factors—capital costs of plant, interest charges, labour costs, waste, transport of fuel, smoke, controllability and cleanliness; the latter items making for a better product, speed, healthier conditions, and so forth. But taken together these items give an over-all figure for running an individual plant which often amounts to a very large total in comparison with fuel cost alone. It is the difficulty of getting manufacturers to look at these matters in such broad light that is the biggest obstacle to a faster rate of expansion of gas application—good as the expansion has been in the case of undertakings (examples of success are mentioned in the paper) that have made definite attack to realize the industrial load. Incidentally, we notice Mr. Hems is favourable to the utilization of the two-part tariff in the industrial gas business, and, through its means, he believes the industrial field would be tremendously extended. The author also impresses the importance of industrial gas salesmen knowing all about the competing fuels.

All the foregoing bears more or less upon the purely commercial aspect of making a change from the use of a crude to a refined fuel. But there is another important consideration, and it is that, the nearer the change is made to technical exactitude, the greater will be the benefits in process and output efficiency and economy. How is this to be realized by the smaller undertakings, to many of which, as Redditch has proved, the industrial load is of great importance? As Mr. Hems remarks, the large undertakings can look after themselves; and all experience confirms him in his declaration that for the smaller and medium sized undertakings there is urgent need for an authoritative body. We have seen Mr. Rendle's acknowledgment of how he has thankfully availed himself of the advice of the specialist staff of the Industrial Gas Laboratories at Birmingham. But all gas undertakings are not geographically so fortunately situated as to have within reach such generous facility for, and willingness to, help. The argument ends at the ideal of the establishment of a central Industrial Gas Sales and Service Organization (on the lines of the already founded schemes of the Gas Light and Coke Company, the South Metropolitan Company, Sheffield, Birmingham, and other places), the services of which would be available to any undertaking, however small, in developing the industrial load. Arrangements could be made for industrialists to have recourse to the same organization. The great point about the development of the industrial gas business is that to each process, whatever its nature, application must be made on technically correct lines in order to realize the maximum advantage. When this is done, there is good profit, compared with the old fuels, to be divided between manufacturer and gas supplier; and simultaneously the business of the makers of industrial gas appliances will be extended.

The Daily Press and the Gas Industry.

In industrial life the power of the Press in shaping public opinion has been recognized more extensively the last few years than previously. It has an influence which can be used for good or its antithesis. When used for good, sound knowledge is usually at the base; when the contrary, there may be nothing vicious about it, but it may be often due to ignorance of the subject. It was only when the British Commercial Gas Association came into being that the gas industry fully woke up to the knowledge of the power that the Press possesses in relation to the immediate interests of gas. However, even now there is frequently found much ignorance among the staffs of the daily journals of the country regarding the operations of the industry. Some attempts, but far from universal ones, have been made to correct this. In our opinion, the best way to effect the change is to bring the members of the Press into close contact with the actual work of the industry—its manufacture, distribution, and public service, and not the last-named alone. The part of our activities regarding which the greatest nescience prevails among the workers on newspapers is the technical side. They have little idea as to the processes, their extent, and their importance in our domestic and industrial life. And thus it is that, by comparison with electricity, we sometimes suffer in the daily papers. There are ways and means of altering this; and on every opportunity advantage should be taken of them.

In this country it is necessary for an industry to approach the Press; the Press will not approach the industry to get educated on matters of importance to the general public. In Belgium, the members of the newspaper world appear to be a very active body, and of an inquiring turn of mind. They desire to know what is being done outside those matters which are to them of daily and immediate concern, and what is their bearing upon the life of the people whom their journals serve. Last week, we had in this country a deputation of distinguished representatives of the Belgian Press, who were desirous of learning something as to the lines industry is pursuing here. Artificial silk and the multifarious operations of

Port Sunlight came within their itinerary, and so did the gas industry. And the opportunity was taken to invite several of their British confrères to join them on Thursday last, which was the day devoted to coming into contact with the affairs of our industry. The Imperial Continental Gas Association were very properly the hosts at a luncheon; and the Gas Light and Coke Company provided the intellectual treats of the day. In the public services of Belgium, the Imperial Continental Gas Association take a leading part, as is seen year by year from the addresses to the proprietors of Sir Charles Jessel, Bart., D.L., who, with several of his colleagues, was at the Savoy Hotel on Thursday to entertain, with their British colleagues, the visitors from the country of our heroic allies. With the visitors were Mr. A. F. P. Hayman, who is in charge of the interests of the Association in Antwerp, and M. H. de le Paulle, who is the Manager of the undertaking of the Association in Brussels. Both those representatives are held in high esteem by the journalistic world of Belgium, and are personally known to many newspaper men. There is a great deal in such personal relationship. Journalists often want to know; and instead of assumption which frequently betrays ignorance, friendship is a channel for acquiring direct, sound, and valuable information. The collaboration of the Gas Light and Coke Company in the visit enabled the deputation to acquire information as to the great advances which have been made in this country in the utilization of gas, and the service which is rendered to maintain and develop its popularity. The guests were also enormously interested in the vastness and ramifications of the productive work of the gas industry, so richly in evidence at Beckton. They were also struck by the excellent relationships which, through co-partnership, are found existing between employers and labour in the gas industry and at Port Sunlight. The visitors returned to their country greatly enlightened in these matters. Their quest here for information will be valuable to the gas industry in Belgium, and anything accomplished in that way will be sufficient reward to the Gas Light and Coke Company. The gas industry at home may not directly gain much from the visit; but the influence of the public Press in every country is such that what was shown and seen here on the occasion of the visit is bound to be reflected in the Press of Belgium, and go to increase the bonds which knit together the two nations. These journalists travelled far to see; they saw, and were impressed.

We repeat, gas undertakings at home should see that the Press in their own areas are not behind in elementary knowledge of general gas affairs, which should start at manufacturing operations, and end at the varied utilization of the products. Contact with operations is a method that produces among journalists the best results.

The Cardiff Meeting.

The notifications of members of The Institution of Gas Engineers of their intention to be present at the annual meeting in Cardiff now number 720, and additions are constantly being made. Members will be gratified to learn that the President of the National Gas Council, Sir David Milne-Watson, will be present at the meeting, and will be one of the guests at the dinner which is to be given by the President on June 11 to the Council and others.

Electrical Refrigerator Campaign.

The Electrical Development Association have developed an affection for campaigns. The six months' Circle campaign quietly expired at the end of March; and just about as little as it was possible to say has been said about it. It was not all that it was hoped it would be, and interest flagged somewhat. Now that food preservatives are to be taboo, it is thought that the time is ripe for a propaganda campaign on behalf of electric refrigerators. Its duration is to be from June 8 to June 25. There are to be inaugural luncheons; it being the view that such functions are positively the best known means of gaining the interest of the Press, and a share of their news columns. There are to be window displays, special local advertising, and direct mail advertising. There are some carping critics who are asking what is the good of having a campaign for electric refrigerators, to get possession of which is beyond the purses of the mass of people, and are only within the reach of caterers on the large scale. Their idea is that the effort could be better expended on something which has a large appeal through coming within the means of the many. Gas undertakings, without a campaign, are bringing gas-operated refrigerators before likely customers.

The Two Unions.

The ballot of the Nottinghamshire miners which was organized by the General Council of the "T.U.C." to endeavour to test which of the two Unions the men prefer—the old Miners' Association which is a branch of the Miners' Federation or the new Industrial Union—resulted in a return of 32,277 for the former, and 2533 for the latter. The figures are not representative; for the members of the Industrial Union were advised not to take part in the ballot. There have been all sorts of rumours afloat as to the indiscriminate distribution of voting papers and plural voting. It has also been asserted that the men were pressed to vote for the old Union, in favour of which the "T.U.C." engaged in an intensive campaign—scattering speakers over the whole of the coalfield to exert the necessary passing influence. All this has gone on notwithstanding the extremist control of the Miners' Federation, and the pious denunciation of the tactics of its leaders by the General Council of the "T.U.C." However, the important thing is not a ballot taken during a torrent of counsel and in an atmosphere of excitement, but the membership of the two Unions. Mr. George Spencer, M.P., says the new Union has a membership of upwards of 20,000, compared with considerably less than 10,000 in the old Union. What effect the ballot is going to have on the position it is difficult to see. Neither the coal owners nor the Industrial Union are perturbed.

Hire Purchase and the Law of Distress.

Reference was made to the new Hire-Purchase Bill in our issue for April 11 (p. 105). In the House of Commons on May 4, Sir James Agg-Gardner moved the second reading of the measure; but the interest of the House in it is shown by the fact that, after some discussion, it was found there was not a quorum of members present (40), and a count was called, with the result that only 24 members were found to be in attendance. Therefore the Speaker declared the House adjourned. From this it does not appear likely that the measure will be heard of again this session, nor possibly in the next, as after the crushing criticism of the Solicitor-General (Sir F. B. Merriman) revival would be of no avail until, if ever, a more fitting opportunity comes along. Local authorities, especially those who are also housing authorities, are not in favour of the proposals in the Bill. They view it very much as does the Solicitor-General. His fear is that the result of the exemption of hire-purchased goods would be simply to paralyze the law of distress, not only with regard to rent, but to rates and taxes. Another effect of the Bill would be to induce the hire-purchase trader to proclaim even more loudly than at present the advantages of the hire-purchase system, which could be advertised as including exemption from any form of distress for rent and taxes. We can well understand the Government not approving of the Bill in view of their interest in taxes and excise duties. There are other objections, one of them being that the Government are not desirous of giving any artificial stimulus to the hire-purchase trade at the expense of those who trade on the basis of selling goods for cash. The London County Council, who are the largest landlords in London (owning some 35,000 houses and flats), consider that, if the Bill were passed, it would necessitate an increase of rents in order to cover losses arising from the proposed alteration of the present law of distress, and an augmentation of rates to make good losses not covered by increased rents. The gas industry is interested in the matter in a dual sense. On the one hand, the system of hire-purchase is adopted by some undertakings; and on the other, a large part of the gas business is on credit. The houses of many new gas customers are in these days in all probability furnished completely on the hire-purchase system. Those are considerations which cannot be overlooked when discussing the extension of the protection of hire-purchased goods.

ELECTRICITY SUPPLY MEMORANDA.

Our electrical contemporaries are getting very busy with the subject of overhead lines and wayleaves. It is an ancient theme for them; but with the Government electricity scheme in process of development, and the worthy desire existing in the industry to carry expensively obtained and transmitted electricity to the benighted regions of our land, the question has intensified in interest. As so important does the electricity industry regard the penetration of rural areas by electric conductors that, to gain their end (no matter whether or not profitable), they would like to ride roughshod over private ownership, and have little regard for public safety. The great ambition is to scout the right to protection of both private owners and the public, in order that the cheapest of disfiguring overhead transmission may be brought to bear. The Electricity Commissioners have issued their new overhead line regulations, and the general feeling in our electrical contemporaries appears to be that they will not go far to assist in cheapening electrical development in the rural areas. It is urged that the transmission of electricity is a more important problem than its generation, and all who are technically versed in the subject are aware that bulk generation is not going to affect costs at the consumers' meters to any material extent, unless the expense of transmission and distribution can be substantially reduced. It is, therefore, in the latter respect that it was hoped some powerful change would be introduced in the regulations which would influence charges in the lower direction. The regulations and difficulties created by the Post Office and the troubles of wayleaves are considered to be the chief obstacles to advance. Those difficulties still stalk through the regulations; and the Commissioners are charged with having kept an anxious eye on not doing anything to create trouble with that well-entrenched specimen of bureaucracy—the Post Office—and with having generally had safety uppermost in their minds. We can commend the Commissioners for their attitude in respect of safety. On the whole, as we gather from the "Electrical Times," and from an article by Mr. W. Fennell in the "Electrical Review," there is disappointment that the Commissioners have not seen their way to comply more liberally with the wishes of the electricity industry.

Overhead Line Regulations.

Line Heights and Sanctions.

Our friend the "Electrical Times" states that in the regulations slight modifications have been made in the requirements and procedure relating to the Post Office. The counsel is given by the Commissioners that where it is intended to run high voltage lines parallel for any appreciable distance with Post Office routes, those concerned should confer with the postal authorities before applying for consent. Our contemporary regards this as being to the good; and it suggests that it would also help matters if the Post Office would reciprocate, and confer with the power people when planning new roads for their lines. There is objection to having to obtain permission from Whitehall for the erection of overhead lines. The submission is made that, provided local authorities and landowners agree, there should be no necessity to waste time and money by appealing to a quarter which cannot do justice to the problem. An excellent review of the regulations is spoilt by this piece of childishness: "It should be as easy to put up a rural line as to lay a death-dealing gas-main." Treating of safety, it is considered that the regulations are very heavy on light lines in respect of ice loading and gales. What is regarded as an acceptable concession is that the minimum height of low tension conductors has been reduced from 20 ft. to 19 ft. across public roads and carriage ways, and to 17 ft. along them. A height of 15 ft. may be adopted in situations inaccessible to vehicular traffic. With the reduction of the minimum height from the ground, it is pointed out that many lower voltage lines will be able to pass beneath other lines—such as telegraphic or telephone wires; and the Postmaster-General will then be satisfied as to guarding if a single earthed wire is run above the power lines for the length of the span. The "Electrical Times" suggests that, to be logical, the Post Office should at crossings use the same minimum conductor and the same ice loading and factors of safety as the supply authority, as what is "sauce for the goose" should be "sauce for the gander."

Other Points.

It is also indicated that no reduction is made regarding the minimum height of high-tension conductors, but some relief is given, in a way, because the minimum heights of earth or auxiliary conductors can conform to those required for low tension, although the minimum height of earth wires, &c., was not definitely stated in the old regulations. Again there is recognition of the possible use of conductors at different voltages on the same post; but approved arrangements must be made to obviate danger to linesmen and from leakage or contact between the high tension and the low tension. Respecting high-tension lines along and across roads, the old regulations remain. As to road crossings, the "Electrical Times" regards duplicate insulators as reasonable; but the device to ensure the earthing of a falling wire—in other words, some form of forked guard—has its objections. In further criticisms our contemporary states that the use of an earth wire with high-tension lines has material advantages; but its adoption, if the ice loading is to be allowed for, means about 33 p.ct. extra pole strength as compared with rural lines in most countries. It makes the admission that "a radiator in a bathroom is much more dangerous than a high-tension overhead line in a village." Finally, there is admission that praiseworthy efforts have been made by the Commissioners to lop off some excrescences, yet there is a great deal of leeway to be made up regarding red tape. In some other countries they have also red tape, but those in control have more personal experience of rural work, which makes a difference. Again, "many of those interested in rural distribution will be disappointed over the whole affair; but at least the principle has been admitted that excessive costs tend to kill progress, even if excessive caution has stood in the way of more tangible results." The Electricity Commissioners will not regard the criticisms of the "Electrical Times" as being either friendly to them or to the results of their labours in this direction.

Dilatory Movement.

The subject of overhead lines has also been dealt with by Sir Philip Dawson in a letter to "The Times." His first point has reference to the delay that at present obtains in securing the consent of the Minister of Transport after inquiries have been held (which are also much delayed) in respect of overhead distribution systems. Sir Philip gives an example of dilatory movement. Upwards of twelve months ago, he says, negotiations were started for permission to carry overhead lines across the Thames. After lengthy negotiations and much delay, the Thames Conservancy refused their consent, as a result of which an inquiry was held by the Electricity Commissioners, who sent in their report to the Minister of Transport some two months ago, but as yet no decision has been given by the Minister. With the proposals the landowners on either side of the river are in agreement, and many people in the neighbourhood are said to be clamouring for an electric supply. Nevertheless, the conditions demanded by the Thames Conservancy would, Sir Philip alleges, have made the cost of electrification prohibitive; and upon this comes the unreasonable procrastination on the part of those who have to investigate such matters and give decisions.

Comparisons with Sweden.

Plausible comparisons of Sweden and this country in respect of electricity supply are frequently made; but in connection with them there is no mention of the great differences which exist between the two countries. Sir Philip Dawson states that in Sweden overhead lines cost from £100 to £200 per mile, while with us, owing to the conditions hitherto imposed, the cost is five or six times as much. He tells us that local amenities, safety of life, and continuity of supply are as carefully considered in Sweden as they are with us. But the result of the Swedish policy has been that the average consumption of electricity per head of population to-day is about 600 units per annum; and it is estimated that in 1940 this will have increased to over 1400 units—an estimate nearly three times as much as that made by the Electricity Commissioners for Great Britain in the same year. Now, in making such comparisons, there is no value in prognostications; existing facts are the only things which matter, and are reliable. In Sweden there is water power, and coal has to be imported; the result being that in that country the gas supply has not been developed to the same economic degree as it has been in this country, with such great advantage to the community. That is a condition which largely accounts for the difference in the consumption of electricity per head of population between this country and Sweden. The one has got water power for electricity; the other has not. The one has got coal for gas, with highly developed and efficient gas undertakings; the other has its gas undertakings, but they labour under great disadvantages. Sir Philip also states that in rural areas in Sweden farmers pay 2½d. and 3¾d per unit for light and power, with a load factor of from 25 to 40 p.ct. In those prices, considering the conditions in Sweden, we do not think there is anything about which to make a great song. However, the letter concludes with the remark that, unless something is done and done quickly to enable cheap distribution to be carried out in this country, the Electricity Act of 1926 can never carry out the purposes for which it was passed.

Fatalities and Overhead Wires.

In the second paragraph of this "Memoranda," reference is made to the childish remark in the "Electrical Times" regarding "death-dealing gas-mains." But nothing is said by our contemporary about the quick passage from life to death which many people have

suffered through coming in contact with electric wires. Recently several electrocutions due to overhead electrical distributors have been reported. Among them was one at Dreghorn in February, when three men lost their lives (see "Memoranda" for March 7, p. 608). Lately an inquiry has been held at the Kilmarnock Sheriff's Court into the occurrence. No new facts were disclosed; but the question arose as to the height from the ground of the overhead electric cable which did the lamentable mischief. It was stated by the Manager of the Ayrshire Electricity Board that the wire had been erected in accordance with the regulations. That being so, it shows that the regulations are deficient in the matter of safety. To their formal verdict, the jury added a rider to the effect that the Electricity Board should see that overhead electric wires are kept up to regulation standard, that danger notices are erected at all danger points, and that a safety wire is constructed at dangerous points near dwelling houses.

NOTES ON NEW BOOKS.

"ELECTRICIAN" ANNUAL TABLES.*

The "Electrician" Annual Tables of Electricity Undertakings have reached the respectable age of 41 years; and from small beginnings the book has become a compendium of data which constitute a survey of the electrical concerns of the Empire, and, indeed, of the world. It has grown more dignified with age, and more exact, which is as things should be, though, of course, in compilations of this kind there is bound to be a little lag between the gathering-in of the particulars and their publication, which may put some of them slightly out of court. But the same applies to official returns. In this case we may mention, as an example, the prices of gas in the Metropolitan area. They are now lower per therm than those quoted in the tables, though the higher figures would have been applicable a few months ago. In handily arranged form, there is information as to the electricity supply undertakings of Great Britain and Ireland—all in alphabetical order, save those in the London area, which are separately grouped. The particulars include the system of supply, generating and transmission voltages, number of public lamps, maximum load, total connections, steam-raising plant, generating stations, converting plant, output, tariffs for lighting, power, heating, and traction, showrooms, &c. Subsequent tables give information regarding small British undertakings, schemes projected, &c., British power companies, descriptions of British equipment, colonial and foreign undertakings, colonial railways and tramways. The particulars embrace 800 British undertakings and 1300 colonial and foreign concerns. The book will be a constant desk companion, and will be frequently referred to.

* "'Electrician' Annual Tables of Electricity Undertakings." London: Ernest Benn, Ltd. Price 10s. net; postage 9d. extra.

Association of Public Lighting Engineers.

A full programme has been arranged for the fifth annual meeting and conference, which will be held in Sheffield from July 9 to 12; the President Elect being Mr. J. F. Colquhoun, Lighting Engineer, Sheffield. For the business meetings in the Council Chamber of the Town Hall several papers have been promised, in addition to the Presidential Address. The Chairman and Directors of the Sheffield Gas Company will entertain members and delegates at luncheon; the Association will have their annual dinner; and a number of interesting visits are being arranged. The Secretary (Mr. W. J. Liberty) has made application to the Ministry of Health regarding the expenses of delegates; and he is authorized to intimate that the Minister sanctions, under the Local Authorities (Expenses) Act, 1887, the payment of the reasonable expenses incurred in connection with the attendance of two delegates (one of whom should be the Engineer or Superintendent for Public Lighting in the district) in the case of any local authority whose accounts are subject to Government audit, and who may wish to be represented at the proposed conference. Individual applications to the Minister for sanction in respect of the conference will not be necessary so long as the proposed expenditure is within the limits indicated.

Yorkshire Junior Gas Association.—A meeting of the Association will be held at Elland on May 19, when Mr. R. Crowther, of the Elland Gas Company, will read a paper on "Some Types of Mechanical Handling Plants."

Midland Association Visit to Willenhall.—The spring general meeting of the Association will be held at Willenhall, on the invitation of the President, Mr. W. G. S. Cranmer, and the Chairman and Directors of the Willenhall Gas Company, on Thursday, May 24. In the morning there is to be an inspection of the gas-works, which will be followed by luncheon in the Chamberlain Hall. An interesting programme of visits has been arranged for the afternoon. Members will assemble at the gas-works, Short Heath, at 11.45. For members travelling by train, a motor conveyance will leave Wolverhampton High Level Station (L.M. & S.) for the works at 11.40.

PERSONAL.

Prof. A. SMITHELLS, F.R.S., has resigned the Chairmanship of the Joint Fuel Committee of The Institution of Gas Engineers, the Coke Oven Managers' Association, the Society of Chemical Industry, and the Institute of Fuel, owing to the extension of his responsibilities in other directions; and the Committee have accepted his resignation with deep regret. Dr. C. H. LANDER has been elected his successor as Chairman.

The Franklin Institute have awarded the Walton Clark medal to Mr. A. G. GLASGOW, of Messrs. Humphreys & Glasgow, Ltd., London, in recognition of his work on the technology and development of the manufactured gas industry.

Mr. JOHN IRWIN has been appointed Managing Director of the West Cumberland Bye-Products Company, Ltd., in the place of the late Mr. Wilfrid Irwin; and Mr. S. JACKSON has been appointed Chairman.

FORTHCOMING ENGAGEMENTS.

[*Secretaries of Gas and Kindred Organizations are asked to assist in making this diary of events as complete and useful as possible by sending the earliest intimation of all meetings.*]

May 17.—SOCIETY OF BRITISH GAS INDUSTRIES.—Annual general meeting at the Hotel Cecil, W.C. 1, under the presidency of His Grace the Duke of Sutherland.

May 18.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—Visit to the works of the Rochester, Chatham, and Gillingham Gas Company.

May 19.—SCOTTISH JUNIOR GAS ASSOCIATION (EASTERN DISTRICT).—Annual general meeting in Edinburgh. Presidential Address of Mr E. L. Farquhar.

May 19.—YORKSHIRE JUNIOR GAS ASSOCIATION.—Meeting at Elland. Paper on "Coke" by Mr. R. Crowther.

May 21.—COKE CONFERENCE, Grosvenor Hotel, Westminster.

May 22.—CENTRAL COMMITTEE OF THE FEDERATION OF GAS EMPLOYERS.—Meeting at the Hotel Cecil, 10.30.

May 22.—CENTRAL EXECUTIVE BOARD OF THE NATIONAL GAS COUNCIL.—Meeting at Hotel Cecil, 11 o'clock.

May 22.—FEDERATION OF GAS EMPLOYERS.—Annual general meeting at the Hotel Cecil, 2.15.

May 22.—NATIONAL GAS COUNCIL.—Annual general meeting at the Hotel Cecil, 3 o'clock.

May 23.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS (EASTERN DISTRICT).—Meeting at No. 28, Grosvenor Gardens, S.W. 1, at 2.30.

May 24.—BRITISH COMMERCIAL GAS ASSOCIATION.—Conference of the Cornish District at Truro.

May 24.—MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—Spring general meeting at Willenhall.

June 2.—NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION (AUXILIARY SECTION).—Half-yearly meeting at the Gas Office, Grainger Street, Newcastle-on-Tyne, 2.30 p.m.

June 11.—BUTE LODGE.—Emergency meeting to welcome the masonic members of The Institution of Gas Engineers.

July 4-5.—ASSOCIATION OF STATUTORY INSPECTORS OF GAS METERS.—Annual conference in Birmingham.

July 9-12.—ASSOCIATION OF PUBLIC LIGHTING ENGINEERS.—Annual meeting and conference at Sheffield.

THE INSTITUTION OF GAS ENGINEERS.

All meetings take place in the Council Room at 28, Grosvenor Gardens, unless otherwise stated.

May 21.—Emergency Committee meeting at the Grosvenor Hotel, Westminster.

May 21.—Finance Committee meeting at the Grosvenor Hotel, Westminster.

May 21.—Council meeting at the Grosvenor Hotel, Westminster.

May 21.—Benevolent Fund Committee of Management meeting at the Grosvenor Hotel, Westminster.

May 21.—Luncheon to the President, by invitation of the Council, at the Grosvenor Hotel, Westminster.

May 22.—Gas Investigation Committee in morning; Effluents Committee and Sulphate of Ammonia Committee in afternoon.

June 11.—Council meeting at the Park Hotel, Cardiff.

June 11.—Dinner to the Council, by invitation of the President, at the Park Hotel, Cardiff, Sir David Milne-Watson, guest of honour.

June 12.—Council meeting in the Cory Hall, Cardiff.

June 12-15.—Annual General Meeting at Cardiff.

June 14.—Council meeting in the Cory Hall, Cardiff, for the appointment of Committees for the year 1928-29.

July 10.—Gas Education Committee.

Oct. 9.—Gas Education Committee.

Nov. 13.—Executive Committee of Gas Education Committee.

Dec. 11.—Executive Committee of Gas Education Committee.

PRESENTATION TO SIR DAVID MILNE-WATSON.

CO-PARTNERS IN THE GAS LIGHT AND COKE COMPANY SUBSCRIBE FOR A PORTRAIT.

An event of far wider significance than to the Company—large as that Company is—in connection with which it occurred, took place on Saturday evening last at Olympia, when the co-partners of the Gas Light and Coke Company presented to the Governor, Sir David Milne-Watson, LL.D., D.L., his portrait by Sir William Orpen, K.B.E., R.A. The occasion was a remarkable one in that it was the outcome of a spontaneous movement originating with the Co-Partnership Committee of the Company, who wished to take advantage of the occasion of the conferring on Sir David of a knighthood to mark their loyalty and their high appreciation of him. The Committee, having been in close touch with Sir David for many years, realized particularly the large extent to which he had been the moving spirit in starting in the Company, not only co-partnership, but pension funds, benefit clubs, and many other schemes for humanizing the relationship among all ranks in the Company's service. From the Committee, the movement spread rapidly through all ranks, and was enthusiastically taken up, so that over 13,000 co-partners finally subscribed for the portrait which was handed over in their presence at Olympia. The scene will long remain vivid in the memories of those who were privileged to witness it. Obviously it was a great pleasure to all to do honour to their Governor; and equally obviously Sir David was highly gratified—as, indeed, he could not fail to be by the enthusiasm of the audience which thronged the vast building. The real spirit of co-partnership revealed itself; and it was this that made the event of such wide significance.

While the co-partners were streaming into Olympia from all parts of the Gas Light and Coke Company's huge area, the band of H.M. Royal Horse Guards (the Blues) performed; and after the presentation refreshments were provided, and there was a varied entertainment which was thoroughly enjoyed.

When the time arrived for the Governor and Lady Milne-Watson to leave their box for the platform, balconies, stalls, and arena were all filled with those who had come to do honour to their Chief. As Lady Milne-Watson reached the arena, the first pleasing incident of an altogther pleasant evening occurred—the presentation to her of a magnificent bouquet on behalf of the women employees of the Company. Reaching the platform (on the way to which they were enthusiastically cheered by the thousands of co-partners who had risen in their places), Sir David and Lady Milne-Watson were welcomed by the Co-Partnership Committee, representing all ranks of the Company's service.

Mr. R. W. Foot (the Assistant General Manager) and Mr. W. S. Edmonds (who is employed at the Bow Common Works) had been chosen by their fellows to make the presentation; and in the speeches reported below they explained the feelings by which the co-partners had been actuated. Not only has Sir David brought ever-increasing prosperity to their Company, but by giving them security of employment, and by providing through funds for their old age and sickness, and by his manner of dealing with all ranks as man to man, he has made them a united Company.

The Portrait.

After the delivery of their speeches, Mr. Foot and Mr. Edmonds drew aside the scarlet curtains and disclosed the portrait, together with a silver Georgian tea service (made in Edinburgh in the same year as that in which Murdoch first lit his house with gas) for Lady Milne-Watson. At the same time, two spot lights were concentrated on the platform from the opposite balcony. Sir David (who was greeted with cheers, and the singing of "For He's a Jolly Good Fellow") then replied and thanked the co-partners, both on his own account and on behalf of Lady Milne-Watson.

During the entertainment which followed, the portrait was turned round on the platform for all to see. It shows Sir David in his office against the background of the painting by Wylie, of Beckton, as it was some fifty years ago.

MR. R. W. FOOT.

Sir David Milne-Watson,—The purpose of this great gathering of co-partners of the Gas Light and Coke Company is to demonstrate the esteem and regard in which you are held by us all. Two main feelings have actuated us in our desire to show in some tangible way our very high appreciation of the work which you have done. First, we have a deep sense of gratitude for all you have done for the Company itself, for having brought it to so high a state of efficiency, and using increasing competition merely as an inspiration to further effort, for having enabled it not only to maintain, but also to increase its business year by year, and throughout your successful conduct of the Company's business for having shown in so many practical ways that you have had at heart the welfare of all those who work for the Company. Secondly, we have a feeling of pride in your successful leadership of the gas industry, and also in the work which you have done, and are doing, in the wider sphere of national interest.

It may be said that our feeling of gratitude is prompted by somewhat selfish motives; but for all that—and perhaps, indeed, for that very reason—it is a very real and human feeling. In maintaining the success of our Company, you have to a very large extent given us that sense of stability in our employment which is so important a factor in the happiness of our homes. We feel that, with you as our leader, so long as our work is well done our position is secure; and that I believe is the feeling which before all others gives us such great confidence in you as Governor of the Company. The greatest security we can have is an efficient business; and we know that you are determined to keep the Company up to date, to give it the most modern plant and equipment in every department, and to spare yourself no effort to keep our flag flying high.

A Genuine Spirit of Co-operation Founded upon Goodwill.

But just as you have realized throughout your career with the Company that efficiency is the main factor in success, so also have you realized that complete efficiency is impossible unless there runs through all grades of the Company a genuine spirit of co-operation founded upon, and inspired by, goodwill. That this feeling of goodwill exists in the Company will, I know, be endorsed by every member of it present to-night—indeed, this very gathering is the best evidence of it that you could have—and it is to your example and inspiration that this goodwill is largely due.

And how has it been attained? Principally, I think, by the breaking-down of the greatest barrier in the path of goodwill in industry—mutual misunderstanding and mistrust. The breaking-down of this barrier must inevitably be a slow process. There is no royal road to it. Many things have contributed to the increasing feeling of understanding and confidence in this Company—and all of these have been inaugurated while you have been either our General Manager or Governor.

I think you will agree that first and foremost should be placed our co-partnership scheme, which, by making us all shareholders in the Company, has not only given us a real sense of ownership, and therefore a personal interest in the success of the business, but has also given us a valuable means of saving against a rainy day or inevitable old age. And you, as Chairman, know how valuable a link between the Directors and the co-partners generally is the Co-Partnership Committee.

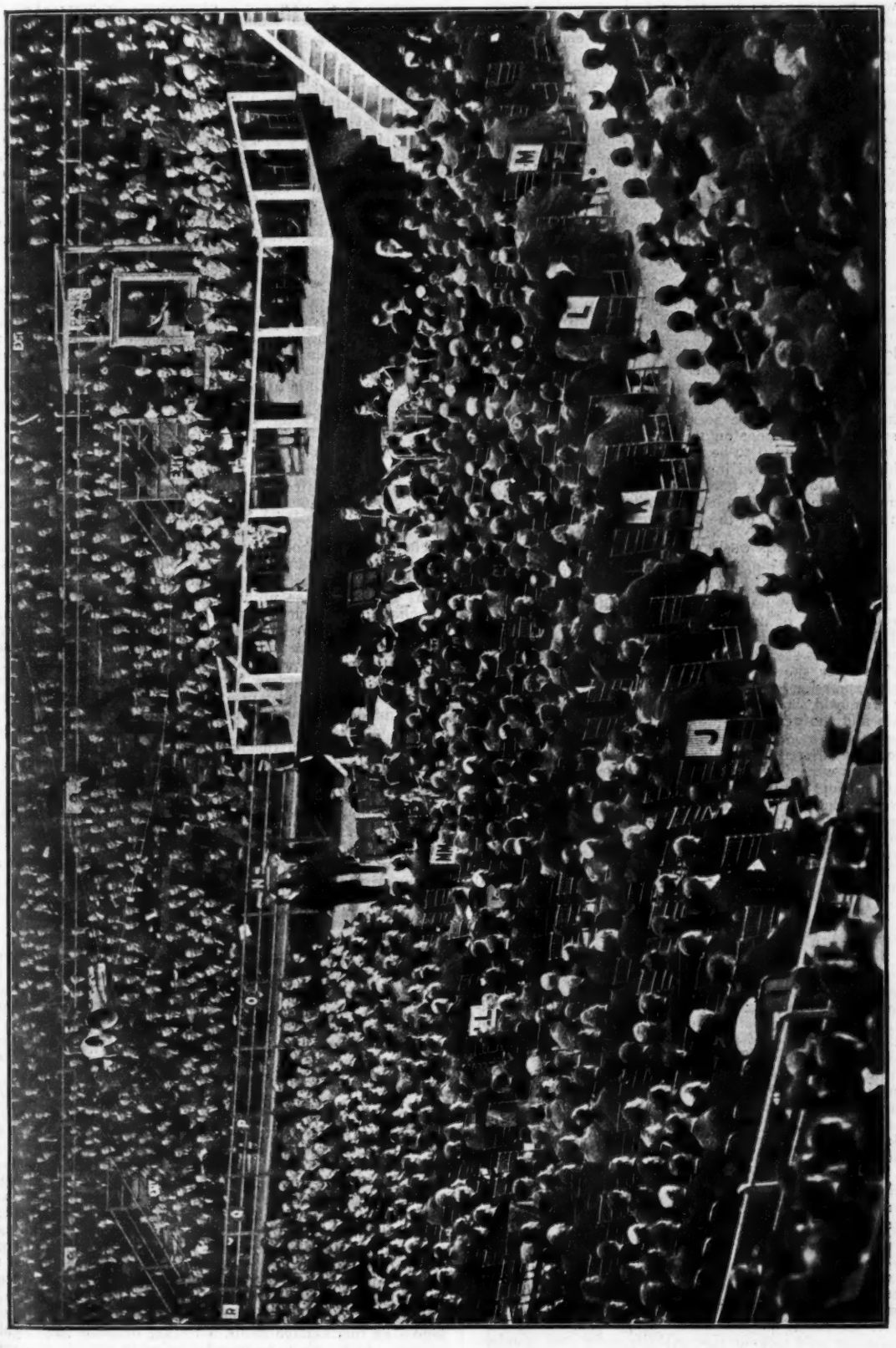
No one knows better than you of our Pension Funds, our Benefit Societies, our War Memorial Fund, all of which are making us more secure and independent in our old age or in times of sickness or distress. We have our Works Committees, through which the Heads of Departments and Engineers are brought into direct touch with the elected representatives of the general body of workers, thus giving opportunity for the discussion of difficulties and the removal of misunderstandings. Our Sports Association, with its fine sports grounds in the East and West of London, and its club rooms, not only provides us with splendid facilities for recreation, but also forms a common meeting ground for all grades of the Company. And, in addition to all this, we have the knowledge that we have as our leader a man in whom we have confidence and trust. [Applause.]

Our Feet are on the Right Road.

It would not be right for me to give to the world outside the impression that we in the Gas Light and Coke Company have solved all our difficulties, and, in effect, found a second heaven on earth. Difficulties are still bound to arise, and misunderstandings to be created; but we do feel that there is now in the Company such a spirit of goodwill and mutual trust as will enable those difficulties to be solved and misunderstandings to be removed. We feel that our feet are on the right road; and we would like to assure you that it is our desire to march steadily forward along that road, with you as our leader. ["Hear, hear."]

We have also a great feeling of pride in the successful part which you have taken, not only in the affairs of the gas industry, but also in affairs of national importance. There is no opportunity to-night to dwell at length upon all your activities of this kind; but I would like to refer to the fact that you have been for many years the President of the National Gas Council, and from its start the Chairman of the Joint Industrial Council of the Gas Industry.

Then, also, in affairs of national importance you have taken an active part, and have brought to all this work that same



THE GREAT ASSEMBLY OF GAS LIGHT CO-PARTNERS AT OLYMPIA.

great knowledge of industrial matters, that same sense of fairness and impartiality, which we in the Company respect so much. And in no work are these qualities of greater importance than on the Committee which is concerned with the promotion of goodwill in industry. In wishing you all success in your work on this Committee, the co-partners of the Company feel that you will be strengthened by the knowledge that you have at your back a Company that has already advanced far along the road that leads to industrial peace.

Honour Bestowed Where Honour was Due.

For all these reasons, it was therefore with the very greatest pleasure, and with a sure sense that honour had been bestowed where honour was due, that we learned that His Majesty the King had bestowed upon you the honour of Knighthood. There then arose in the Company a spontaneous feeling that the moment was appropriate to mark in some tangible way our respect and regard for you. This spontaneous feeling first found expression among the elected members of the Co-Partnership

Committtee, and from these the idea spread by way of the Works Committees through the entire Company. In all sections it was received with immediate and general approval. Everywhere the response was instantaneous and in every step that has been taken from the beginning to the end there has been complete concord and co-operation.

The outcome is that we shall shortly ask you to accept from us your portrait, which has been painted by Sir William Orpen, R.A.; and we shall also ask Lady Milne-Watson to accept from us a Georgian silver tea service as a personal memento of a great occasion. It will interest you to know that the tea service was made in your native city of Edinburgh in the same year as that in which Murdoch first lit his house with gas.

Sir David, we are here to-night as a united Company to ask you to accept your portrait as a token of our esteem and regard for you personally, and as a token also of the loyalty of a great Company to a great Governor. [Cheers.]

MR. W. S. EDMONDS.

Sir David, Lady Milne-Watson, Ladies and Gentlemen, and Fellow Co-Partners,—It is with the greatest pleasure that I second the proposition so very ably proposed by Mr. Foot. In fact, so fully has he covered the ground that there is really nothing left for me to say. I would like to mention here, by the way, that it was the unanimous wish of the workers' representatives that Mr. Foot should be the principal speaker on this occasion; and I am sure that we are heartily in agreement with all that he has said. I have been chosen for the honourable duty of seconding Mr. Foot on this very rare and auspicious occasion because I happen to be the oldest member of the Co-Partnership Committee, and have therefore had a longer experience of the Governor's good qualities than perhaps any other representative of the employees; and I can assure you all that I am extremely proud of the privilege.

An Expression of Esteem and Regard.

This presentation is, I believe, an historical event, not only in our Company—the largest in the gas industry—but also in a national sense, and, to my mind, is especially welcome at a time when the spirit of unrest is everywhere so much in evidence. This testimonial arose out of the spontaneous wish of the workers; and as soon as it was spoken of all grades in the Company's service showed a desire to contribute, in order to mark their expression of the esteem and regard in which the Governor was held, and in appreciation of his interest in co-partnership and the general well-being of the employees.

We co-partners are fortunate in working under conditions which are very different from those which existed years ago. The advantages we enjoy under our scheme and in our service with the Company are well known; and there is no need for me to give the details. It is always a great pleasure to meet the Governor at the co-partnership meetings. We can always express our opinions without fear. We can speak frankly to the Governor, as one man to another. ["Hear, hear."] The Governor never turns a deaf ear to any genuine appeal on behalf of the general body of the workers; and he is a great believer in justice. That is a very good quality, and one worth possessing, as I believe that one great reason for unrest is that the worker does not always get justice.

Confidence in the Governor.

The Governor has our goodwill and confidence. It may be that at times we might have misunderstandings and difficulties, as in every other industry, for men are only human; but granted the continuation of the existing goodwill and mutual confidence, there is never any need to allow differences to degenerate into quarrels. When there have been differences, we have been summoned to discuss and confer together; and in his wisdom those difficulties have been amicably solved. I am therefore a convinced and enthusiastic co-partner; and from my personal knowledge of the advantages of co-partnership, I really cannot understand why the system is not more generally adopted. Sir David has been for years a keen supporter of co-partnership, not only financially, but, what is more precious with a very busy man, in giving of his valuable time to fostering the true co-partnership spirit.

Proud of the Honour Bestowed.

In seconding this proposition on behalf of the workers, I would like to say, Sir, that we were specially proud to hear of the well-merited honour which had been conferred upon you by His Majesty the King, and we were also proud to hear of the high compliment paid to your ripe experience by your nomination to the Committee appointed to consider the relations between employers and workers. Your interest in the welfare of all the employees, your desire for personal contact, your love of justice, and your very human and sympathetic nature, have earned for you the sincerest respect and loyal support of us all. May you long live in health and strength to carry on your good work. [Applause.]

SIR DAVID MILNE-WATSON.

Mr. Foot, Mr. Edmonds, Ladies, and Gentlemen,—I find it very difficult to say all that is in my heart this evening. The kindness of your words, the wonderful reception you have given me, and the beautiful portrait you have presented me with, have completely overwhelmed me; and it is very hard for me to find words at all adequate to express my feelings. The things which have been said about me by Mr. Foot and Mr. Edmonds make me feel very self-conscious; and I can only hope that half of what has been said about me is true. I shall always remember your very kind words.

The portrait which has been presented to me is a most beautiful painting; and I shall always treasure it among my most valued possessions. I wish to thank you all, co-partners, for your most handsome gift. I wish also to thank you on behalf of my wife for the beautiful Georgian tea service (which was made in my native city) which you have presented to her, and for the kind thought which prompted it. I was afraid Mr. Foot was going to say the year in which I was born. [Laughter.] I know my wife will never forget this evening and your goodness. It is a great pleasure to her to be included with me in your esteem and affection.

Whether the portrait is a good likeness or not, I must leave to others to say. I myself think it is. I value the portrait, as a picture painted by so great a master as Sir William Orpen, to whom it has been a great pleasure to sit; but I appreciate it still more for the kind thought which inspired it, and as an expression of your goodwill towards me—particularly coming, as it does, spontaneously from so vast a number of co-partners.

I am a very proud man this evening. It is not always possible for one in my position, having been General Manager for fifteen years and Governor for ten years, if one does one's duty, to do the things that are popular. Discipline must be maintained, and "No" must sometimes be said. It is therefore a very great pleasure to me that, after all these years, you should have these kindly feelings towards me.

A Symbolic Gift.

The gift is symbolic, I believe, of the spirit which has been engendered in the Company by co-partnership. It means that, notwithstanding the great size of the Company, and the enormous growth in the number of its employees, there is yet a personal link which binds us all together. It has been said that large companies and big corporations destroy all personal relationship between employers and workers. That, however, would not be so, in my opinion, if the co-partnership spirit prevailed. In this Company we are all interested in the success of the undertaking; and we are all out to make it a great and successful one in the best sense of the word. If I have been able, in my position as your head, to help to bring this about, I am indeed happy. [Applause.] In my view, what the world wants to-day is a greater sense of fellowship in industry. We cannot all be masters; but we can all be happy in our daily round of work, if we only take sufficient interest in the welfare of the business. All the work which we do cannot possibly be interesting. There is drudgery in everyone's task—even, believe me, in that of the Governor. In this connection, I should like to quote a couple of lines from the poet George Herbert, which seem to me to be very appropriate:

> "Who sweeps a room as for thy laws
> makes that and the action fine."

That puts the whole thing in a nutshell. We must all try to realize that our work, however humble it may appear, is for the same object—it is for the good of the Company as a whole, not for one section. It is not merely for the management, the workmen, or the shareholders, but for all these interests combined. If we do not remember this, and work only for one section, the whole of the edifice of the business will be endangered, and will ultimately fall.

Pride and Loyalty Needed in Business.

It is often said by critics of co-partnership that it is not worth while, as the financial results will never be great enough to have any real effect. These critics make this great error: They only see the material result, and miss the real thing—the spiritual side. It is the feeling of mutual interest that we are all really part one with another. That if one is hurt, everyone is hurt. That we can approach each other in a friendly spirit, and explain mutual difficulties. That there is no hard-and-fast line between the heads of the business and what used to be called "the hands." That the heads and hands are members of one body, and cannot do without each other.

What we want—and what we have, I think, in a special degree in this Company—is a feeling of pride and loyalty in business, such as is to be found existing in schools, universities, and regiments. The feeling that when someone does wrong he has let-down the business, and when he has done right he is bringing it respect and honour. If that feeling exists, there is no need to worry about the size and growth of the business.

What has happened to-night is a proof and a symbol that this state of things exists in this Company; and that is what makes your gift so precious, and what makes this evening so great in the Company's annals. You have done me a great honour; and you have given me great happiness. I am deeply touched and I can only say once again from the bottom of my heart, "I thank you." [Prolonged cheers.]

BELGIAN JOURNALISTS AND THE BRITISH GAS INDUSTRY.

Inspection of the Kensington Showrooms, the Head Offices, and the Beckton Works of the Gas Light and Coke Company.

Last week a deputation of Belgian Journalists, who were accompanied by a few members of the Belgian gas industry, including M. Paul Couvreur, General Manager of the Compagnie Continentale du Gaz en France, visited this country with the primary object of inspecting English newspaper practice, and with the secondary object of gaining first-hand knowledge of certain of Britain's industrial activities. In addition to visits to the "Daily Mail" and other newspapers, they were able to see how artificial silk is manufactured here, and to learn something about the work of Messrs. Lever Brothers at Port Sunlight. From conversation with many of the deputation, it appears that one of their most vivid impressions of industrial conditions in this country is the understanding between employer and employed—what they termed a sense of stable loyalty.

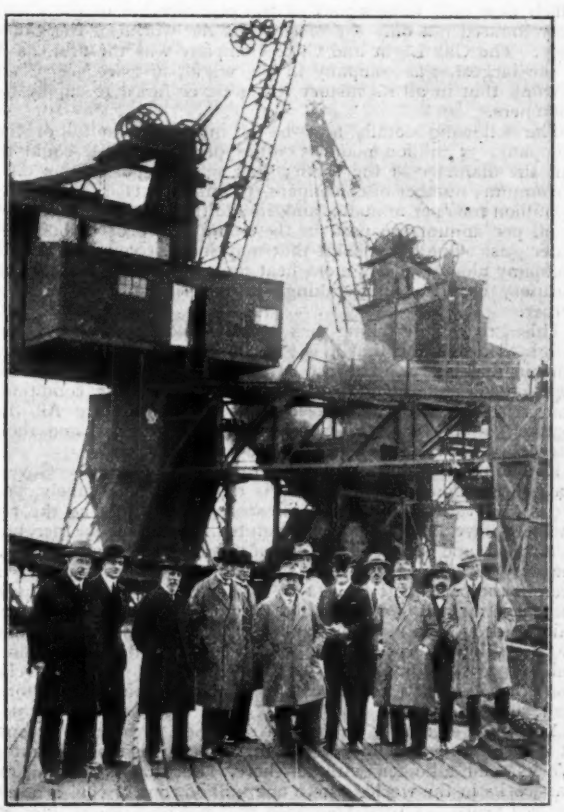
The Imperial Continental Gas Association, who operate in Belgium, were naturally keenly interested in this visit, and several officials of the Association accompanied the deputation. Among them were Mr. A. F. P. Hayman, the Manager of their Antwerp Undertaking, who, as M. F. Reynders (President of the Belgian Press Association) said, is a great friend of the Belgian Press—and M. H. de le Paulle, Manager of the Brussels Station of the Association. Co-operating with the Gas Light and Coke Company, the Association arranged that the deputation, while on their visit, should have an opportunity of inspecting not only the manufacture of gas at the largest gas-works in the world—the Beckton Station of the Gas Light and Coke Company—but also the distribution and service methods of the Company. The idea was greatly appreciated by the deputation, as also were the excellent arrangements which the Company made for their inspection. It would not be going too far to say that the visitors were frankly astonished at the virility of the gas industry in this country and at the organization of the Gas Light and Coke Company, which ensures the satisfaction of well over a million consumers. The invitation included English journalists, so that the visitors were able to meet their confrères in this country.

Of course, the deputation were not in any way prepared to witness the ebbing activities of a waning public service, for their experience of the Belgian gas industry, which is going from strength to strength, made any such notion impossible. Electricity is cheap in Belgium, but this does not prevent gas from being used practically universally for cooking and heating. Mr. Hayman explained that the consumption per head of population in Antwerp is no less than 120 cub.m. per annum, and that this figure is a growing one. In Belgium, though there are several municipally-owned gas concerns, the bulk of the supply is from company undertakings.

The inspection of gas service in London took place on Thursday last, and commenced at the Church Street Showrooms, Kensington, of the Gas Light and Coke Company. Following a tour of these premises—which, as members of the gas industry in this country realize, embody the ideals of good gas service made practicable by the most up-to-date and efficient methods—the visitors were conveyed to the Head Offices of the Company in Horseferry Road, where they were formally welcomed by Mr. Henry Woodall, M.Inst.C.E., the Deputy-Governor of the Company, with whom were Mr. R. W. Foot, O.B.E., M.C. (Assistant General Manager), and Mr. F. W. Goodenough, C.B.E. (Controller of Gas Sales).

Welcome to the Gas Industry's Birthplace.

Mr. Woodall, addressing the assembled guests in the Board Room, said: It is with much pleasure that I welcome you to our Central Offices. I am very sorry, as I am sure you are, that our Governor, Sir David Milne-Watson, is not able to be here to-day. He is abroad on an important mission, and greatly regrets being unable to receive you. We regard it as a privilege to meet you gentlemen from Belgium, as we cannot forget that we have recently shared, and won through, many trials and hardships. There are many links binding our two countries together, and a not unimportant one is the Imperial Continental Gas Association, which has for so long a period supplied many of your cities with gas to, I believe, the mutual satisfaction of all concerned.



It is a particular pleasure to me to be here to-day. I have many Belgian friends—some of my earliest engineering work was done in your beautiful city of Brussels, and I had the honour to be Engineer for the important Hoboken Works of the Imperial Continental Gas Association just outside Antwerp. My father, the late Sir Corbet Woodall, whose picture you see at the end of this room, was for many years Consulting Engineer to the Imperial Continental Gas Association, and later a Director; and when I visit Antwerp I am always interested to see a statue of him in a niche on the façade of the Imperial

Continental Gas Association's Offices in the Place de Meir. At the other end of the room you will see the portrait of Winsor, who more than a hundred years ago founded this Company.

This is the home of the gas industry. In 1812 this place, which now only houses part of the organization of the Company, housed not only the offices, but the works of the Company. The Gas Light and Coke Company was the first, as it is the largest, gas company in the world, and we are proud to think that in all its history it has never failed to supply its customers.

The following details may be of interest: Capital of the Company, 35 million pounds; miles of main, 3885, equal to half the diameter of the earth; gas sold, 46,350 million c.ft. per annum; number of consumers, 1¼ millions; coal carbonized, 2½ million tons per annum; and, in addition, 20 million gallons of oil per annum are used in the manufacture of carburetted water gas. One other point that may interest you is that this Company alone supplies more heat units than the whole of the statutory electrical undertakings in the British Isles put together.

This great undertaking has steadily increased, and I am delighted to tell you that it is growing now faster than at any time in its history. The use of gas is being more and more appreciated, and the industry is in a very healthy condition. Our relations with our work-people are excellent. All the regular employees of the Company are co-partners, and their interest in the Company amounts to over £750,000.

Round these walls you see portraits of many of the Governors of the Company, but there is one omission—namely, our present Governor—but this will soon be rectified, as the co-partners have had his portrait painted. Every co-partner has subscribed, and on May 12 12,000 of them will meet at Olympia, the only building in London large enough to hold them, to present the portrait to Sir David. They, the co-partners, know they have a great Governor, and they decided that only a great painter should paint him; and the picture has been painted by Sir William Orpen. This will be an important and almost unique occasion, and is one of many proofs of the good relations that exist between all classes of the Company—Directors, staff, and workpeople.

You have seen this morning a specimen of our showrooms at Kensington, and later you will, I hope, visit our Beckton Works, and take tea with us there. Beckton is the largest gas-works in the world, where one million tons of coal are carbonized yearly. I trust your visit will not be without interest, and welcome very heartily the opportunity of showing you our works and offices, and thank you for your presence here to-day.

M. Jean de Voghel, Chef de Cabinet de M. Heyman, Ministre de l'Industrie et de Prévoyance Sociale, having apologized for the absence of M. Heyman, who was unavoidably detained in Brussels, said how greatly he appreciated the sympathetic remarks of Mr. Woodall. As a country, Belgium was under a debt of gratitude to Great Britain for their succour during the war, and as representing the Belgian Press, those present were under a debt of gratitude to this country for their splendid welcome, and to the Gas Light and Coke Company for giving them such a magnificent lesson in methods of gas service.

Guests of the Imperial Continental Gas Association.

As guests of the Imperial Continental Gas Association, the visitors were entertained at luncheon at the Savoy Hotel. They were received by Sir Charles Jessel, Bart., D.L., Chairman of the Association, who afterwards occupied the chair. Apart from the toasts of H.M. The King, and H.M. The King of the Belgians, which were proposed by the Chairman, there were no speeches; but Sir Charles Jessel read a telegram received from M. H. Heyman, the Belgian Minister of Labour. This was as follows: "*Vifs regrets retenu Bruxelles. Envoie hommage de sympathie à puissante industrie gaziére anglaise.*"

Beckton Visited.

The visitors, accompanied by Mr. Thomas Hardie (Chief Engineer of the Gas Light and Coke Company), Mr. W. B. Leech (Chief Engineer, Beckton), and Mr. R. W. Hunter (Resident Engineer, Beckton), were then conveyed to the Beckton Works of the Gas Light and Coke Company. Time did not allow of detailed inspection of these, the largest, gas-works, but there was opportunity of viewing the expanse of the works from the railway, and of seeing the new coal-unloading plant which was opened by the King in July of 1926. This plant, which is the largest of its kind in Europe, is designed to provide a total coal unloading capacity of 2000 tons an hour when discharging two ships simultaneously with eight cranes in operation. There was time, too, to inspect one of the retort houses, where interest was shown in the signalling device which immediately informs the retort house foreman of any falling-off in the calorific value of the gas being made. When a green lamp is alight, all is well; a red lamp, however, indicates that conditions are not what they should be.

Thanks to the Two Companies.

The tour of inspection completed, the visitors were entertained by the Company at tea.

M. F. Reynders, President of the Belgian Press Association, in thanking the Imperial Gas Association and the Gas Light and Coke Company for their kindness and hospitality, said that what the deputation had seen of the gas industry that day must convince them that the industry, far from being dead, or dying, was one of the first industries in the world. He spoke in glowing terms of the work of Sir Charles Jessel and Mr. F. H. James, Secretary of the Imperial Continental Gas Association, and referred to Mr. Hayman as "a great friend of Belgium and of the Belgian Press." He thought it was opportune, too, to mention how grateful the deputation were to M. E. Van der Geten, the Secretary of the Belgian Press Association, who had done so much to make their expedition to England a success.

Mr. T. Hardie, Chief Engineer of the Gas Light and Coke Company, replying on behalf of the Company, said how pleased he was to see the deputation at the Beckton Works, and how

glad the Company were to be able to give them a general impression of the largest gas-works in the world. The Company were particularly pleased to see journalists, because, as a rule, journalists were on the look-out for something new, and there was a feeling that newer processes received a good deal of attention simply because they were new, whereas gas, in spite of its service to the community, was apt to be forgotten. The Company were also delighted to have with them representatives of the Imperial Continental Gas Association.

Mr. H. G. PALMER, a Director of the Imperial Continental Gas Association, responding on behalf of the Association, expressed their pleasure in entertaining Belgian and English journalists at lunch, and their gratitude to the Gas Light and Coke Company for the opportunity of inspecting the Beckton Works.

At the conclusion, M. Van der Geten presented to the visitors a booklet which he had written entitled "Souvenir d'une Visite aux Usines à Gaz de Beckton (Londres)." The greater part of this was an abstract from the author's "Un Siècle d'Eclairage," an engrossing history of gas lighting which was published in 1927 and reviewed in the columns of the "JOURNAL." At the end of this souvenir brochure M. Van der Geten has given an impression of the Beckton Works, and statistics which show that gas stills holds 50 p.ct. of the public lighting of London. In his opening paragraphs he says:

> There is a legend, albeit unjust, which represents the gas industry as an eternal moribund. When we look around, we cannot but recognize that this reputation is either born of a partisan spirit or based upon gross incompetence of judgment. Those who entertain the belief must at any rate grant that the Beckton Works stand as a magnificent mausoleum for the centenarian industry.

SEWAGE AND SULPHATE OF AMMONIA EFFLUENTS.

The System Adopted at Stafford.

In a paper which Mr. W. PLANT, Assoc.M.Inst.C.E., Borough and Water-Works Engineer of Stafford, read, on April 28, before the Institution of Municipal and County Engineers, he included a section dealing with sewage disposal combined with the effluent from the sulphate of ammonia plant at the Corporation Gas-Works. We reproduce this part of the contribution, which shows that experimental investigation with a working unit has proved that the sewage and the effluent can be dealt with successfully by the system adopted. The result is the construction of an installation adequate for the treatment of the whole of the borough sewage and gas-works effluent.

In 1918 small-scale experiments on the activated sludge (diffused air) principle were commenced, and carried on for a period of twelve months. These experiments proved that the Stafford sewage, which, owing to the presence of salt works in the town, has an abnormally high chlorine figure, was amenable to treatment by this process.

ACTIVATED SLUDGE PLANT: DEMONSTRATION UNIT.

In the year 1925, one complete working unit, consisting of aeration tank, re-activation tank, and settlement tank, was installed, and has been dealing with one-sixth of the total flow of sewage containing the spent liquor from the sulphate of ammonia plant at the gas-works for more than two years, and has produced a uniformly stable effluent, notwithstanding the fact that the sewage has had no preliminary treatment beyond passing through coarse screens. The object of putting down this demonstration unit in the first instance was to ascertain what effect this spent gas liquor had on the process, the relative capacity of tanks required to treat the sewage with and without gas liquor, and the total capacity of the plant necessary to deal with the whole flow of sewage mixed with gas liquor.

It was realized at the outset that the gas liquor could not be handled satisfactorily unless the flow to the disposal works was equalized day and night throughout the year; and before the plant was brought into operation, a balancing-tank capable of holding 120,000 gallons of spent liquor was put down at the gas-works in which to store a portion of the liquor when the sulphate plant was at work, and from which it could be pumped later into the sewers at a predetermined rate when the plant was at rest.

The information obtained during the running of this demonstration plant showed that six similar units were required satisfactorily to treat the whole of the sewage mixed with gas liquor; and this number has been included in the scheme now in course of construction. After careful consideration, however, it was decided to instal two detritus tanks, in order to provide some preliminary settlement, and thereby reduce the amount of air required to purify the sewage effectually. Sludge concentration tanks are also being installed to reduce the water content of the surplus sludge before discharging it on to sludge lagoons or ploughing it into the land.

AERATION AND RE-ACTIVATION TANKS.

The four existing precipitation tanks are being converted into aeration and re-activation tanks by raising the walls 2 ft. 6 in. to obtain an effective working depth of 8 ft. 6 in. Two new aeration tanks are being constructed, similar in design, making six in all.

The dry-weather flow of sewage with a certain amount of subsoil water is about 900,000 gallons per day, or rather more than 30 gallons per head; but as a considerable quantity of rain water finds its way into the sewage sewers, this figure is increased to as much as 1½ million gallons per twenty-four hours during heavy rains. The total quantity pumped to the disposal works during last year was 387 million gallons.

The total capacities of the various tanks are as follows:

	Gallons.
Two detritus tanks	160,000
Six aeration tanks	454,500
Six re-activation tanks	151,500
Six settlement tanks	199,200
Two sludge concentration tanks	41,600

The whole of the work is being constructed in concrete made from sand and gravel found on or near the site. Each aeration tank is divided into three channels 7 ft. wide. The diffusers are arranged along one side of the channels, causing a spiral movement of the sewage. The settlement tanks and the sludge concentration tanks have inverted pyramid-shaped bottoms; the former having four cones and the latter one cone to each tank.

SLUDGE.

The sludge is raised from the bottom of the cones by the water pressure above, and is then lifted into the re-activation tank by an air lift, where it is again subjected to blowing; the major portion passing into the aeration tank to meet the incoming sewage.

Provision is being made for dealing with the surplus sludge in any one of three ways—returning it into the detritus tanks with the fresh sewage, passing it through the sludge concentration tanks and then into lagoons or direct on to the land. Owing to the elevation of the tanks above the surrounding land, it will be possible to deliver sludge to any part of the present filtration area without further expenditure of power. The final effluent from the settlement tanks will be drawn-off over weirs running along three sides of the tank and down the centre. This effluent will then be collected into one channel and discharged over a weir 5 ft. wide, down a spillway, where it will be further oxygenated before passing along an 18-in. diameter effluent main to the river.

"Clifford" inlets are being used for delivering the crude sewage into the detritus tanks, the mixed liquor into the settlement tanks, and the surplus activated sludge into the concentration tanks.

AIR COMPRESSORS.

Two small electrically-driven air compressors now in use will be retained in the complete scheme, and three more compressors and motors, each capable of compressing 1000 c.ft. of free air to a pressure of 5 lb. per sq. in. per minute, will be installed. The experience gained so far has shown that the quantity of air required to purify completely the mixed sewage and gas liquor without preliminary treatment is about 2½ c.ft. per gallon. The four-hour oxygen absorption figure for Stafford sewage mixed with an even flow of gas liquor averages about 11·5 parts per 100,000; and the corresponding figure for the final effluent from the activated sludge unit is about 1·2. It is anticipated that the introduction of detritus tanks will reduce the initial figure to about 8·5 parts per 100,000, so that an improvement in the final figure or a reduction in the volume of air used may also be looked for.

The quantity of surplus sludge removed averages at present about 10 p.ct. of the sewage flow. When the sludge concentration tanks are in use, it is expected that this quantity will be reduced to about one-third, or (say) 3 p.ct. of the sewage flow.

The whole of the machinery and equipment is being installed by Activated Sludge, Ltd.; the English Electric Company, of Stafford, providing the motors.

The total cost of the scheme, including all equipment, 240 yards of 18-in. diameter effluent main, sludge lagoons, &c., will be about £27,000.

The author is conscious of the fact that, in view of his statement that one of the reasons for putting down the demonstration plant was to ascertain the relative capacity of tanks necessary for treating the sewage with and without gas liquor, he will be expected to say something on this question and on the expense entailed in running the system. The quantity of spent liquor from the sulphate plant varies considerably; but the average quantity passing into the sewers may be taken at about 200 gallons per hour, or about half of 1 p.ct. of the total volume of sewage. The strength of this liquor also is very variable. The four-hour oxygen-absorption figure (average over numerous samples) is 750 parts per 100,000; individual samples varying from 450 parts to 1500 parts per 100,000. The experiments have shown that it would be just possible to treat the

whole of the sewage without gas liquor in four units of the dimensions proposed, whereas six units are required to deal with the sewage mixed with the gas liquor.

Running Costs of Demonstration Unit.

The running costs of the demonstration plant when dealing with sewage and gas liquor combined, including labour charges, oil, and current at 1d. per unit, but exclusive of capital charges and depreciation, work out at about £9 per million gallons treated, as against £7 15s. per million gallons of sewage without gas liquor. In view of the fact that more than half this cost is for labour (which, owing to the small size of the plant, is not economically employed), the figures given are altogether misleading when considering the running costs of the complete scheme. When the whole plant is in operation with preliminary settlement, larger and more efficient compressors, and labour used to much greater advantage, the running costs, obviously, will be materially lower than those stated above. The author has gone carefully into the question of costs in the light of the experience gained, and estimates that the average cost of dealing with the whole of the sewage and gas liquor will be in the neighbourhood of £5 10s. per million gallons.

MIDLAND JUNIOR GAS ASSOCIATION.

Annual Meeting.

The Annual General Meeting of the Association was held at the Council House, Birmingham, on Thursday, May 10—Mr. H. R. Hems presiding.

The report (which stated that the membership stands at 239, including 20 honorary members) was adopted on the motion of Mr. W. E. Cadwallader (Birmingham), seconded by Mr. H. S. Adams (Bilston); and the financial statement was also approved.

Mr. F. Caudwell (Distribution Superintendent at Shrewsbury) will succeed Mr. Hems as President.

Mr. A. R. Myhill (Central Laboratory, Nechells Gas-Works, Birmingham) becomes Senior Vice-President; and the election by the Council of Mr. W. Macnaughton (Wolverhampton) as Junior Vice-President was announced. It was stated that Mr. Macnaughton had been a member of the Council for two years; and had rendered useful service.

To fill two vacancies on the Council, Mr. W. E. Cadwallader, for Birmingham, and Mr. F. A. Jenkins (Leamington), as a district representative, were elected.

Mr. Hems announced that Mr. Spinks, who had been Hon. Secretary of the Association for the past few years, was unable to accept re-election. He had been tactful, and had shown organizing and administrative ability. A vote of thanks was passed to Mr. Spinks, on the motion of Mr. Hems, seconded by Mr. C. F. Tooby (Coventry). Mr. Spinks, in reply, said the Association might count upon his future support.

Mr. H. C. Wills (Central Laboratory, Nechells) was elected Hon. Secretary, and Mr. F. A. Grant (Gas Department, Birmingham Council House) Assistant Hon. Secretary.

The meeting unanimously confirmed the re-election as Honorary Treasurer of Mr. G. W. Smith; and to him a vote of thanks was passed. Mr. Walter P. Timbrell was invited again to accept the office of Hon. Auditor.

Messrs. W. Macnaughton, R. G. Marsh, W. L. S. Spinks, and H. R. Hems were re-elected to the Midland District Education Committee.

It was announced that Mr. G. C. Pearson (Engineer of the Windsor Street Works, Birmingham) had accepted hon. membership of the Association.

COAL AND BYE-PRODUCT EXPORTS.

During March the exports of coal were considerably below the shipments for the corresponding months of the two preceding years; and the values were also on the low side. Up to the present, the coal-marketing schemes (one object of which is to attempt to recover the old quantitative standards in the markets abroad) do not appear to have shown their intended boosting influence. Probably the time is too short to see the effects from the efforts contemplated by the plan of campaign.

Coal Exports.

In March, the quantity of coal sent abroad was 4,110,663 tons, compared with 4,819,912 tons in March, 1927, and 4,702,536 tons in March, 1926. The values of these quantities were: 1928, £3,248,126; 1927, £4,459,789; 1926, £4,184,079. In these figures, gas coal was represented by 533,050 tons in March of this year; 664,337 tons in March, 1927; and 642,034 tons in March, 1926. The value in March of this year was £397,854, which averages a fraction over 14s. 11d. per ton. The value in March, 1927, was £573,036, and in March, 1926, £526,238.

In the first three months of this year, the shipments of coal totalled 12,022,994 tons, as against 13,085,647 tons in the first quarter of 1927, and 13,190,584 tons in that of 1926. The values of these amounts were: In the three months of this year, £9,474,495; in the corresponding period of 1927, £12,733,277; and in that of 1926, £12,031,042. Comparing the figures for the first three months of this year with those for the same period of last year, it is seen that the quantity of coal exported was 1,062,653 tons less, but the reduced value is no less than £3,258,782. In the foregoing, the returns of gas coal for the first three months of the year are represented by 1,565,282 tons, as compared with 1,741,185 tons in the same period of 1927, and 1,747,963 tons in that of 1926. The values of these quantities were: 1928, £1,174,993; 1927, £1,553,367; 1926, £1,424,382.

Gas Coke Shipments.

The amount of business abroad in gas coke in March was 45,841 tons, as against 71,997 tons in March, 1927, and 78,965 tons in March, 1926. The values of these quantities were: 1928, £47,444; 1927, £82,401; 1926, £81,247. The average value per ton in March was £1 0s. 8·3d.

In the three months, the amount of gas coke shipped was 270,701 tons, as against 193,804 tons in the first quarter of 1927, and 336,611 tons in that of 1926. The values were: 1928, £281,143; 1927, £228,583; 1926, £347,963.

Metallurgical coke is in better favour. In March, 82,949 tons were sold abroad, compared with 32,413 tons in March, 1927, and 99,307 tons in March, 1926. The values were: March, 1928, £83,722; 1927, £48,122; 1926, £112,690. In the three months, 324,047 tons were shipped, as against 87,482 tons in the same period of 1927, and 303,544 tons in that of 1926. The values of these last three amounts were: 1928, £323,627; 1927, 136,060; and 1926, £342,573.

Tar Products.

Very little benzole has so far this year been sold abroad. The quantity disposed of in March was only 5100 gallons, and the total for the three months is merely 5811 gallons, as compared with 22,244 gallons in the first quarter of 1927. A little more business has been done in naphtha, but nothing of any moment. Regarding tar, oil, creosote, &c., the quantity shipped in March was 2,476,914 gallons, which compares with 3,955,677 gallons in March, 1927. The total exports of this group for the first three months of the year were 10,165,577 gallons, as compared with 5,652,687 gallons in the first quarter of 1927. The amount of pitch sold abroad in March was 36,538 tons, as against 38,897 tons in March, 1927. In the first three months of the year, the aggregate sale of pitch was 87,698 tons, as against 87,436 tons in the first three months of 1927.

Sulphate of Ammonia.

A much better business in sulphate of ammonia has been done so far this year than was the case in the opening months of 1927. In March, 23,558 tons were sold abroad, as against 16,594 tons in March, 1927. The total shipment for the three months was 77,958 tons, which compares with 36,161 tons in the first quarter of 1927. This year to the end of March the best buyer has been Japan with 23,227 tons; the Dutch East Indies coming second with 20,162 tons.

Gas Oil Imports.

The amount of gas oil delivered into this country in March was 12,384,702 gallons, which compares with 9,677,344 gallons in March, 1927. In the first three months this year, the delivery amounted to 34,848,629 gallons, as against 36,745,351 gallons in the same period of 1927.

REFRACTORY MATERIALS SECTION OF THE CERAMIC SOCIETY.

SPRING MEETING AT NEWQUAY.

The Spring Meeting of the Section was held on May 3 and 4 in the Atlantic Hotel, Newquay—the President, Mr. H. J. C. JOHNSTONE, in the chair.

NEW DEVELOPMENTS IN GAS-WORKS CARBONIZING PLANT, WITH SPECIAL REFERENCE TO REFRACTORY MATERIALS.

By G. M. GILL.

This paper was copiously illustrated with lantern slides showing the various constructions. Mr. Gill has given much attention to his subject, and first described briefly developments in the United States, Germany, and England. From his intimate knowledge of such developments, he ventured to give a forecast of future developments in English gas-works, in the belief that it might be of some help to those who supply refractory materials. He considers that contracts for new installations of carbonizing plant are likely to range chiefly between continuous vertical retorts and intermittent vertical retorts, with a smaller number of horizontal retorts and ovens. The two vertical systems have some advantageous features; and most gas engineers will almost certainly adopt a method of bulk carbonization in new installations. The continuous vertical retort system being well known in England—where it was originally introduced, and whence it spread abroad—the author devoted more attention to intermittent vertical ovens, which are comparatively new in England.

Intermittent vertical ovens are enlarged modifications of the Dessau system of vertical retorts, which never came into general use in England, but were very largely employed on the Continent. The new ovens are much larger in all dimensions except height, as to which it is very important that it should not exceed about 17 ft. The introduction of bulk carbonization and the large amount of experience gained with the system of intermittent vertical ovens during recent years, coupled with the fact that the developments are in good hands, would seem to be a guarantee against failure. The intermittent vertical oven usually takes a charge of 1·35 to 5 tons of coal with a 12 to 24 hour carbonizing period; the coal being charged by a travelling wagon into two openings at the top of the oven, and the coke being discharged by opening the door at the bottom of the oven. The heating of these ovens is by means of producer gas burnt in the lower part of the oven, the hot gases passing upwards and around the oven, then down through recuperators, and finally through a waste-heat boiler.

Advantages of the vertical intermittent oven system are:

1. It is suitable for any kind of coal.
2. It requires a minimum of ground area.
3. It accommodates itself to the sites of stop-end horizontal retort houses.
4. It can be operated with a minimum of labour, and, if desired, on two 8-hour shifts per 24 hours.
5. The charge can be steamed satisfactorily.
6. The coke will compare favourably with that produced from the same coal in other systems, and will contain a minimum of breeze.
7. It does, and should, produce satisfactory yields of gas, coke, tar, and ammonia from the coal.
8. It is adaptable to the smaller works, while the small cost of plant to operate the ovens is a distinct advantage.
9. The capital cost of the plant and its maintenance costs should compare well with other systems.

All requirements of steam are produced in the waste-heat boiler which is nowadays fitted to these installations. By steaming the charge before discharging the coke, a mixed gas often desirable for consumers can be obtained; and this treatment does not impair the quality of the coke.

Refractory materials for such installations are little different from those required for other systems, in all of which high-class silica material is essential for the walls of the ovens and retorts and the combustion chambers. No other material is now being used in such parts of modern carbonizing plant as installed by the leading builders in England, the United States, or Germany. The lower parts of the vertical retorts or ovens should be as durable as possible, since repairs of those parts are difficult and expensive. The materials for recuperators in modern carbonizing plant should be strong, resistant to cracking, close grained, as nearly air-tight as possible, of uniform size and shape, and accurate finish. Owing partly to the difficulty of meeting all these requirements, modern design tends to extracting waste heat in boilers after providing for partial recuperation only; and this tendency is promoted by the superior designs of English waste-heat boilers. The firebrick material which has no severe conditions to withstand should have uniform shapes and sizes in order to save much labour cost of doing good work.

Vertical installations are well adapted for the use of insulating material—more so than horizontal settings or coke ovens. Improved insulation will render possible the economical variation of carbonizing plant, to suit fluctuating demands for gas. At present the high radiation losses make it wasteful in fuel to operate plant much below its full capacity. Efficient insulation will enable gas companies to avoid the destructive shutting-down of carbonizing plant for the summer months.

Tunnel kilns for the burning of silica material in Germany are heated with producer gas from mechanical producers fired with small coke and breeze; the temperatures in the hottest portion of the kiln being controlled by sensitive draught regulators and pyrometers. In this way, the proportion of defective material is kept very small. Mr. Gill anticipates a wider adoption of tunnel kilns for the purpose.

Standardization of shapes is an urgent problem, which should be tackled by manufacturers and users jointly.

[The full text of Mr. Gill's paper is in type for publication in an early issue of the "JOURNAL."]

VITRIFICATION OF CLAY PRODUCTS.

By A. T. GREEN, F.Inst.P., A.M.I.Chem.E.

This was given as a running commentary on a series of lantern slides exhibiting the numerical values resulting from tests for porosity (apparent and true), sealed-pore volume, &c., of certain fireclay products fired to the vitrifying range. The main outstanding indication was that, although total porosity generally decreased steadily before incipient vitrification, this was followed by a decided increase, though the apparent porosity continued to decrease. It was found that the sealed-pore volume increased considerably during vitrification. Such increase in sealed-pore volume does not appreciably reduce mechanical strength of the vitrified material.

REFRACTORY MATERIAL USED AS MORTAR FOR LAYING-UP REFRACTORIES.

By Prof. D. A. MOULTON.

Pulverized fireclay of similar chemical composition to that of the refractories has generally been supplied for refractory mortars. R. M. Howe tested as mortars fireclay with addition of 3 to 20 p.ct. (and in a few cases up to 50 p.ct.) of portland cement, lime, asbestos, water-glass, salt, or carborundum. With carborundum, in all proportions up to 50 p.ct., the refractoriness was reduced from Cone 30 to Cone 29, with 20 p.ct. water-glass it was reduced to Cone 26, and with other materials it was further reduced by smaller percentages added.

Refractories are at present being laid with a cement made of ground grog or calcined fireclay, with some bonding material to cause the mortar to harden. In one such commercial cement sodium silicate was used; and another commercial high-temperature cement was made of 80 p.ct. fine grog, 14·4 p.ct. silica flour, 4 p.ct. powdered glass, and about 1·6 p.ct. starch. The starch helps to set the grog until it becomes hardened by heating; and the powdered glass was to lower the vitrification range of the grog, so that it could be hardened at a lower temperature. A fine-grained grog cement had over 75 p.ct. of material which passed through a screen of 150-mesh, and only 3·5 p.ct. which remained on 60-mesh and coarser screens. A coarse-grained carborundum cement had only about 38 p.ct. which passed through a screen of 150-mesh, and about 45 p.ct. remained on 60-mesh and coarser screens.

Most commercial high-temperature cements settle rapidly when mixed to the consistency of cream. From 3 to 6 p.ct. bentonite in grog gives excellent mortars, with good working qualities; the fusion range being lowered only from Cone 30 to Cone 28, and with 10 p.ct. bentonite only to Cone 27. These mortars of grog and bentonite do not require frequent stirring to keep them ready for use. Results of tests show that the bond is strong enough to support any height of refractories used in walls and any ordinary load imposed on the refractory lining. "Aquacryptite" is another colloidal material resembling bentonite, and has given similar results as a bonding material.

The setting time of this refractory mortar is variable; being merely a matter of drying. On firebricks having an absorption of 8 to 12 p.ct., it was found to have an initial set in 1¼ to 2 hours, and a final set in 4 or 5 hours; the test being applied in the same way as for portland cement. Such high-temperature cements may be made from either calcined clays or waste refractories (clean scraps) of the same chemical composition as the refractories used. The addition of a colloidal material like bentonite or "aquacryptite" gives a suitable refractory mortar at a minimum cost. This high-temperature cement may be mixed

with coarse grog to make a monolithic lining in various furnaces.

Effect of Substituting High Silica Sands for some Grades in Lime-Bonded Silica Bricks.

By W. Hugill and W. J. Rees.

The results obtained show that Lynn sand is more readily inverted than Totley ganister and that the substitution of 10 p.ct. of Lynn sand in the brick mixture did not affect detrimentally the general properties of the bricks, although in certain cases lower bulk density and higher porosity resulted.

The consideration of other papers was postponed.

DISMANTLING A GASHOLDER AT ELLAND.

Reconstruction Work Points to Need for Examining Old Holders.

Some time ago, the Elland-cum-Greetland Gas Company, of which Mr. J. Bridge is Engineer and General Manager, decided to reorganize their works, and bring the whole of the plant into a highly efficient condition to meet modern requirements. Already a half-million unit of Dempster-Toogood verticals has been installed, together with new steam raising and gas exhausting plant.

A bench of six beds of inclined retorts has recently been demolished; and on the site, work is now in progress for the erection of coke screening and grading plant of the "Cascade" type, superimposed on brick reinforced bunkers. The Company have created a substantial demand for graded coke for domestic purposes; and the new plant will facilitate the expeditious bagging of screened and graded coke. The plant will be totally enclosed in the old inclined retort house; and as the storage bunkers will be capable of storing seven days' coke production, there should be no occasion to stock coke in the open yard.

A horizontal water-tube gas condenser, Livesey washer, and rotary scrubber-washer are also to be installed; and these will be placed on the top of a 73 ft. diameter gasholder tank which is now being covered with a reinforced concrete raft supported on reinforced concrete pillars. A new foul gas main is being provided to connect up to the new condensing and washing plant. Messrs. R. Dempster & Sons, Ltd., of Elland, have been successful in tendering for the whole of the new plant including all connections. The coke screens will be by Messrs. Drakes, Ltd., of Halifax; the condenser and rotary washer by Messrs. W. C. Holmes & Co., Ltd., of Huddersfield.

Dismantling the Holder.

Mr. Bridge informs us that, though it is impossible to obtain the correct date when the holder was built, it is certainly over seventy years ago. It may, in fact, date to the inauguration of the works ninety-one years ago. On cutting off the crown plates, it was discovered that many of the principal bars were seriously deflected, and that in several cases the purlin bars had broken away from the principal bars. The state of affairs is shown in figs. 1 and 2, from which it will be noticed that the crown trussing is of unusual design.

Though the crown and side plates appeared to be in remarkably good condition, it is easy to conceive that, considering the state of the crown trussing, a collapse of the holder might have taken place. In view of this, Mr. Bridge proposes to make a thorough internal inspection of another holder of similar age; and at the same time some of the crown and side sheets will be cut out for testing.

Fig. 3 shows a section of side plates being lifted from the tank; and figs. 4 and 5 indicate how the cast-iron columns were lowered, by a 60-ft. derrick, into the tank. Having been lowered, they were allowed to fall into the tank, and the broken pieces were removed. The holder was dismantled by Messrs. R. Dempster & Sons, Ltd., Elland.

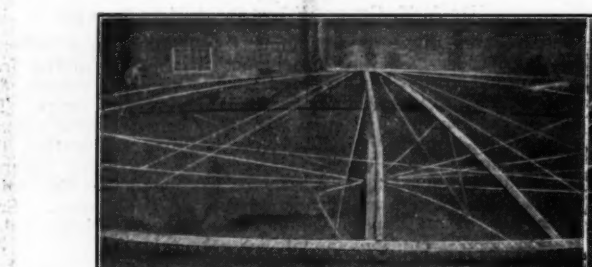


Fig. 1.—General View of Crown Trussing, showing Deflection of Vertical Stays and Tie Bar.

Fig. 2.—Showing Deflection of Main Bar. Purlin Bar Broken Away.

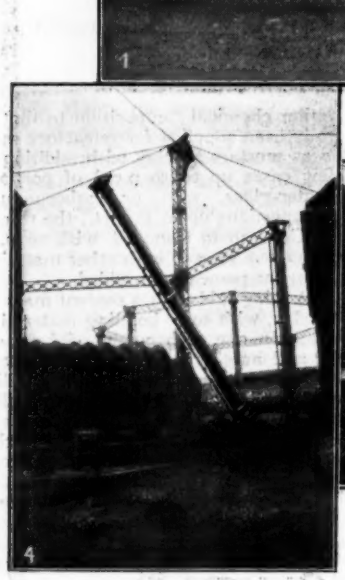


Fig. 4.—Lowering a Cast-Iron Column.

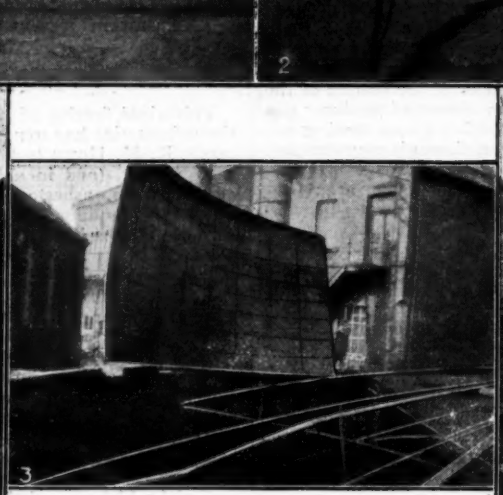


Fig. 3.—A Section of Side Plates being lifted from the Tank.

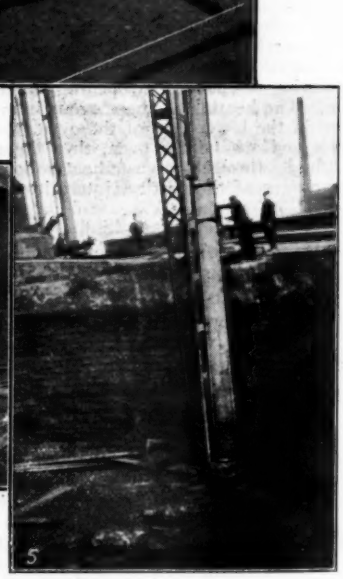


Fig. 5.—A Column being Pushed Over in the Tank.

"B.C.G.A." MIDLANDS DISTRICT CONFERENCE.

Another of the excellent series of District Conferences arranged by the British Commercial Gas Association took place on Wednesday, May 9, when there was a large gathering at Redditch of members in the Midlands Area, under the Presidency of Mr. LESLIE E. CLIFT, the Chairman of the Redditch Gas Company, who performed to the utmost satisfaction of all the duties of host. His welcome was of the warmest; and in his efforts to ensure the comfort of the visitors he was ably assisted by Mr. C. F. W. Rendle (the Engineer and Manager of the Company), Mr. C. R. Hackett (the Secretary), and other members of the staff. Visits in the morning, consideration of the important subject of "Town Gas and Industry" in the afternoon, and an address on atmospheric pollution in the evening, made up a well-filled day.

Three visits had been arranged for the morning, of which the visitors could make their choice; and it appeared that the numbers taking part in each were about equally divided. One was to the Redditch Gas-Works; and the other two—to the works of the Enfield Cycle Company, Ltd., and to those of Messrs. Henry Milward & Sons, Ltd. (manufacturers of needles)—were also of particular interest on this occasion, because of the industrial gas apparatus in use. The firm of Henry Milward & Sons—the largest makers of fine quality needles in the world—was established about 1730, and has been conducted by succeeding generations of the same family since that date. They turn out 800 million needles annually; and the Milward brands are known for their quality in every home in the world.

AT THE GAS-WORKS.

Readers of the "JOURNAL" do not need to be reminded that there are special features at the Redditch Gas-Works; for the paper which Mr. C. F. W. Rendle (the Engineer and Manager) read before the Midland Association of Gas Engineers and Managers last October will be still fresh in their minds. In this he dealt with the application of producer gas firing to waste-heat boilers, and described and illustrated the installation which the Woodall-Duckham Companies have put in at Redditch. Another feature is the recent installation of two sets of Waller reciprocating compressors for the supply of high-pressure gas to Studley, some 4 miles away. The undertaking there was acquired by the Company a short time ago, and the works were closed-down. The Midland Junior Gas Association visited Redditch, during Mr. Rendle's Presidency, in May, 1923, and a full account of the works was published in the "JOURNAL" at that time.

It appears that, for a few years prior to 1859, the source of the gas supply to Redditch was a privately-owned works, situated in Windsor Street. Another works was eventually erected in Clive Avenue, by the late Mr. J. E. Clift, father of the present Chairman of the Company, and one of the pioneer gas engineers in the Midlands. For a time there were apparently two gas-works in Redditch, one of which (that first referred to) fell into disuse. The other, owing to enterprise in management, developed to such an extent that in 1872 it passed from private ownership to the Redditch Town and District Gas Company, Ltd. In course of time it became expedient to seek further powers and to extend the area of supply; and these were granted in the Redditch Gas Act of 1889, when the title of the undertaking was changed to the Redditch Gas Company.

Mr. J. E. Clift, at that time the Engineer of the South Staffordshire Gas Company, which was eventually purchased by the Birmingham Corporation, built the original gas-works at Saltley; and he was responsible for the design of one of the original types of fireclay chamber settings known as Clift's ovens. These ovens followed and superseded the use of the then generally used cast-iron retorts; and it is interesting to note that the gas-making plant at the earlier works of the Redditch Gas Company consisted of an installation of these segmental fireclay retorts.

The site of Mr. Clift's original works was retained, and with subsequent additions is the site of the present works, which to-day occupy an area of approximately six acres. The northern side of the works is bounded by the River Arrow, unfortunately of too modest proportions to permit of navigation; and the eastern boundary is formed by a branch of the London, Midland, and Scottish Railway, from which private sidings penetrate the works in several directions, and afford the means of transit for raw materials and bye-products. Turntables enable the sidings to serve the various portions of the works with a minimum of wastage in ground space; and steam-driven warping capstans are used to shunt rolling stock on the works.

LUNCHEON.

A party of about 130, which included many influential local gentlemen, were the guests of the Redditch Gas Company at luncheon in the Plymouth Hall—Mr. LESLIE E. CLIFT (Chairman of the Company) presiding. "The King" was submitted by the Chairman, who responded also to a subsequent toast. Other speakers included Alderman J. H. Lloyd, Mr. Hubert Pooley, and Alderman Sir Albert Ball.

FRIENDLY RELATIONS.

Mr. J. W. HUGHES, J.P. (Chairman of the Redditch Urban District Council), proposing "The Gas Industry," said he thought gas was one of the most wonderful things the earth had ever produced. Nearly every industry had been aided by some product from coal. As an example, he pointed to the way in which building costs could be reduced by the provision of gas-fire flues. He also pointed to the great assistance which had been rendered by gas in improving the criminal statistics of the country. Proceeding, he said that the relations subsisting between the Redditch Gas Company and the Urban District Council were very cordial indeed. At no time during his experience had there been any ill-feeling. The Council could approach the Company at any time in a friendly manner, and be sure of receiving all possible help. The fact that the Board and their Engineer did everything in their power to give good service to the town was thoroughly appreciated by the Council.

ENCOURAGING STATISTICS.

Mr. HUBERT POOLEY, M.Inst.C.E. (Engineer and Manager of the Leicester Corporation Gas Department), in response, remarked that the confidence of the general public in the gas industry was well shown by the investment since 1920 of £12,544,329 in company undertakings and £17,080,656 in local authority owned concerns. The total capital invested in 782 undertakings returned in the Board of Trade figures for 1926 was £173,830,000, and the money expended by about 9 million consumers in the year 1926-7 was over £74,000,000. It was also stated that there were this year nearly a quarter-of-a-million more gas consumers than there were in the previous year, and that they were taking some 9500 million c.ft. of gas in a year. This growth, in the face of a form of State-aided competition, was most encouraging alike to the investor in the industry and to the worker. The gas industry used coal to the extent of over 18 million tons per annum, and produced somewhere about the colossal quantity of 300,000 million c.ft. of gas in a year. Some 8 or 9 million tons of solid smokeless fuel were also available for the general public in the form of coke.

THE SERVICES OF GAS.

It was a far cry to the days of Murdoch and the time when he illuminated his dwelling at Redruth and, later on, the works in Smethwick; but it was safe to say that for at least a century gas men had had, as they had now, one chief aim in life—to serve their community to the best of their ability. In the old days of the industry this service was a competitive one, with oil and tallow candles holding the field as light purveyors. There was but little of that semi-smokeless solid fuel, the coke of those days, available for general use, and what there was of it was largely akin to the modern low-temperature product. The industry had gone far ahead since then. Their really smokeless fuel was a much better product, dependent upon its carbon content for the heat it yielded, and giving to the public increasing supplies of a constantly improving material, as the demand grew. Their service in light had advanced from a value of perhaps 4 candles per cubic foot consumed to well over ten times that amount. The majority of cities and towns gave a supply of gas which in cost compared most favourably with any of its competitors for power, and which was well known as never failing those who depended upon it. In the heating and cooking demands, which are such features of modern life, gas was supreme, and again the satisfactory nature of the supply, in the widest sense, was apparent. Their commodity was always ready on tap, without notice, and without failure of either supply or apparatus. It was because the general public, in practice, appreciated these services that he had named them.

The CHAIRMAN, calling upon the proposer of the next toast, remarked that they were very gratified to have with them Alderman Lloyd, who had returned from Sicily only the previous evening.

THE REDDITCH GAS COMPANY.

Alderman J. H. LLOYD, M.A., J.P. (Chairman of the City of Birmingham Gas Department), then submitted the toast of "The Chairman and Directors of the Redditch Gas Company." He said he felt that every Birmingham manufacturer ought to have a great respect for Redditch, for though Birmingham had spread so far, and secured a share in so many and so varied types of manufacture, Redditch had retained undisputed supremacy in the old trade she had made her own. They were often told that without leisure there could be no civilization; certainly without Redditch needles present-day civilization would not hold together for long. The visitors had that morning been over a most interesting factory devoted to this old industry which entered so largely into the every-day life of them all. They had also been over another large factory engaged in the younger industry of motor car and cycle manufacture. He regretted that for various reasons one large company engaged in the motor industry had decided to leave Redditch; but he was sure that very shortly the large premises thus vacated would be taken by some other manufacturer quick enough to realize the value of that mechanical aptitude which had been inherited generation by generation by the artisans of the town. He sincerely trusted that whatever manufacture was set up there would be one requiring the consumption of large quantities of town gas. That it would require some gas was inevitable; for just as Redditch needles were found in every home, so town gas was employed to a greater or less degree in every manufacturing process.

ADVANTAGES OF CO-OPERATING WITH GAS UNDERTAKINGS.

The Redditch Gas Company were, he understood, already taking steps to exploit other fields of possible gas consumption, and were

confident that the up-to-date methods they employed would be rewarded. Manufacturers were only now realizing how much they had to gain by co-operating with gas undertakings in the review and revision of their different processes. Redditch manufacturers had cause to congratulate themselves that they had a Gas Company that was modern and up-to-date in its organization, and had already shown in many ways that it fully realized its responsibility to the community as what the Americans would term a "public utility company." As he became acquainted with the policy of gas undertakings up and down the country, it was borne in upon him how much the gas industry and the general community were indebted to those medium sized and smaller undertakings who definitely made up their minds to keep abreast of all improvements in manufacture and administration. Redditch stood well to the fore among the progressive smaller companies; and he was convinced that their attitude must have a really beneficial effect on the general welfare of the community. He knew it had been said many times before, but it was a fact that was still overlooked, that people in the industry were apt to think that both the domestic consumer and the manufacturer were as fully conversant with the uses to which gas could be put as they themselves were. Nothing, of course, was further from the truth. It needed constant vigilance on their part to prevent opportunities for gas consumption being missed—not because the prospective consumer was opposed to gas, but merely because he or she did not know how it could help. He felt sure that in Redditch this constant vigilance existed. The Redditch Gas Company was fortunate in having on its Board gentlemen who had during their lives come into intimate contact with various aspects of the gas industry; and such specialized knowledge was of the greatest value to the Company. Mr. Clift was well known to all of them, and, as Chairman of the Midlands District Board of the National Gas Council for the past three years, had done yeoman service for the industry. The Redditch undertaking was fortunate in having so able and enthusiastic a Chairman. He understood that another Director of the Company was his friend Mr. C. E. Murray, whose experience in the gas industry extended over even a longer period than his (Alderman Lloyd's) own, and whose knowledge of the raw material they used was probably unsurpassed. With such gentlemen on the Board, the shareholders and consumers might rest satisfied that their interests were being carefully watched. He felt sure it would be the wish of those present that there should be coupled with the toast the names of Mr. Hackett (the Secretary of the Company) and Mr. Rendle (the Engineer), whose ability was so well known in the district.

The Board.

The Chairman, replying, declared that it had always been a labour of love to him to do anything he could, first for his Company in Redditch, and secondly in the interests of the gas industry of the country. He was practically born in the gas industry. His father, he thought he might say without being accused of boasting, was a well-known engineer in the industry in the old days. Many years ago he built, he believed, the first Saltley Gas-Works. With regard to the Redditch Company, over which he (the speaker) had presided for more years than he cared to remember, he could say that they did try to study the interests of everybody; and in a policy such as that lay the only future for gas. The most pleasing resolution that ever came before the Board was one which had for its object the reducing of the price of gas. The staff worked most loyally with the Board, as one harmonious family. It had indeed been gratifying to hear the way in which the Chairman of the Council had referred to the excellent relations which had always subsisted between the Local Authority and the Gas Company.

Mr. Charles E. Murray (a Director of the Company) proposed "The Visitors," with the remark that some of the best brains of the country were being devoted to giving the best possible services to the community by gas.

To the Young Engineers.

Alderman Sir Albert Ball, J.P. (Chairman of the Nottingham Corporation Gas Department), who replied first, on behalf of the visitors from the Midlands District, said that though he had long been associated as Chairman with one of the large municipally-owned gas undertakings of the country, he could claim to know nothing about gas; but he had a thundering good lieutenant in his old friend John Wilkinson, who either knew all about it or thought that he did. [Laughter.] What he would like to say, to the young engineers especially, was that, in his opinion, gas had a great future, but that this great future depended entirely upon the rising generation; and if the young engineers were content to sit down and see things rolling on as they were rolling along to-day, they would get left behind. They were up against strong opposition, which was having the support more or less of the Government—unfairly, in his opinion. It was up to the younger men to use their brains and take advantage of every opportunity to keep gas well to the front. His own idea was that the country simply could not afford to stop carbonizing coal in such a manner as to secure all the valuable products; and he believed the day would come when practically the whole of the coal would be so utilized. It was necessary that all of them should take the greatest possible advantage of the work that was being done by the British Commercial Gas Association, who were striving their utmost on behalf of the industry.

Lieut.-Colonel C. F. Milward, J.P., C.A. (Chairman of Messrs. Henry Milward & Sons, Ltd.), who also responded, said that he preserved the happiest recollections of the Chairman's father, who founded the gas industry in that town. From father to the son had been handed down that kindly and genial manner which was so great a help in passing through life to those who were fortunate enough to possess it. The Gas Company at Redditch did their very best to establish goodwill between their public utility undertaking and its customers. It was not always the case that public utility undertakings succeeded in doing this. The railway companies, for example, were now struggling hard to regain some of that popularity which they had undoubtedly lost largely through their treatment of the public.

TOWN GAS AND INDUSTRY.

A public conference in the afternoon, which was held in the Church Institute, was devoted to a paper by Mr. H. R. Hems, of the Industrial Research Laboratories of the City of Birmingham Gas Department. This was closely followed by a large audience, who fully appreciated the time and labour that had been bestowed upon its preparation, as well as upon that of the interesting series of lantern slides of gas furnaces, &c., by which it was accompanied. The paper is, unfortunately, too extensive to allow of doing more here than touch briefly upon some parts and reproduce references to actual uses of town gas in industry.

After remarking that, with manufacturers, the fuel and furnace question is often left alone far too much, Mr. Hems went on to say that the question of actual cost of running a heat-treatment plant is a serious one; but in his experience he has found very few firms who have been able to give him anything like near figures as regards (say) coal consumption when he has suggested the replacement of a coal furnace with an improved design of gas-heated furnace, or even of individual gas consumptions, in spite of the ease with which the last-named figures are obtained. It is most important that fuel costs should be kept, and, further, that those fuel costs should be considered conjointly with the other important factors of capital cost of plant, with interest charges, labour costs, waste, transport of fuel, smoke, controllability, and cleanliness. Taken together, these costs give an over-all figure of cost of running an individual plant, and often amount to a very high figure in comparison with the fuel cost alone. This, unfortunately, is often the only factor which the manufacturer will consider when discussing heat-treatment plants (this term including, of course, not only furnaces, but all the many special appliances which have to be used in works processes).

In turn, the manufacturer rightly expects from the gas industry a supply of fuel at the lowest possible prices. Sliding-scale charges operate in many gas undertakings; but the interest of the industry and the consuming manufacturer should lie in the direction of the new, and to the author's mind fairer, methods of charging for gas which are now being tried-out in some instances, and fully investigated and considered by most gas undertakings. Mr. Hems thinks that the method of making a fixed "consumer" charge, according to the outlay involved in giving the supply of gas, and a low rate for the gas consumed, will be of advantage to the manufacturer, who will feel that he is being charged on his own merits, and not according to the general requirements of the domestic and other consumers included in the supply to a particular area, which latter may include heavy "service" charges for necessary maintenance of appliances, &c. The gas industry cannot but benefit from such a scheme, as lower charges for manufacturing and industrial operations will extend the field for industrial gas to a tremendous extent.

Mr. Hems drew attention to the extent of the industrial field that is open to the gas industry, and then went on to say that he has made it his policy, in dealing with the furnace requirements of a large number of manufacturers both in and out of Birmingham, to endeavour to see the point of view of the manufacturer with regard to all available fuels, rather than to confine his arguments to the advantages of gas. That attitude involves a consideration of other forms of competitive fuels; and if a representative of any gas undertaking, when putting forward his facts to a manufacturer, is in a position to discuss his competitors in the field of application under discussion, his success in bringing in the desired increase in consumption will be far more sure and pronounced than if gas, and gas only, had been discussed at the initial interview.

Sales.

The following figures show the amount of town gas which is taken by manufacturers for industrial processes from several large and small gas undertakings.

The Gas Light and Coke Company sold over 4000 million c.ft. of gas for power and manufacturing operations, and over 2000 new gas-heated trade appliances were fitted in their area during 1927.

The South Metropolitan Gas Company have increased their sale of gas for industrial heating operations (apart from power) from approximately 3,224,000 therms in 1923 to 4,724,000 therms in 1927.

The Smethwick Gas Department sold 19·62 p.ct. of their total output in 1910 for power and manufacturing operations. For the year ended March, 1927, this percentage had increased to 39·14.

Sheffield sells 45 p.ct. of its output of gas for industrial purposes.

Mr. W. G. S. Cranmer, of the Willenhall Gas Company, in his Presidential Address to the Midland Association of Gas Engineers and Managers, gave some interesting figures of consumption and dissections of types of apparatus used in his area of supply, illustrating what a comparatively small undertaking can do—no less than 32·8 p.ct. of the total output during the

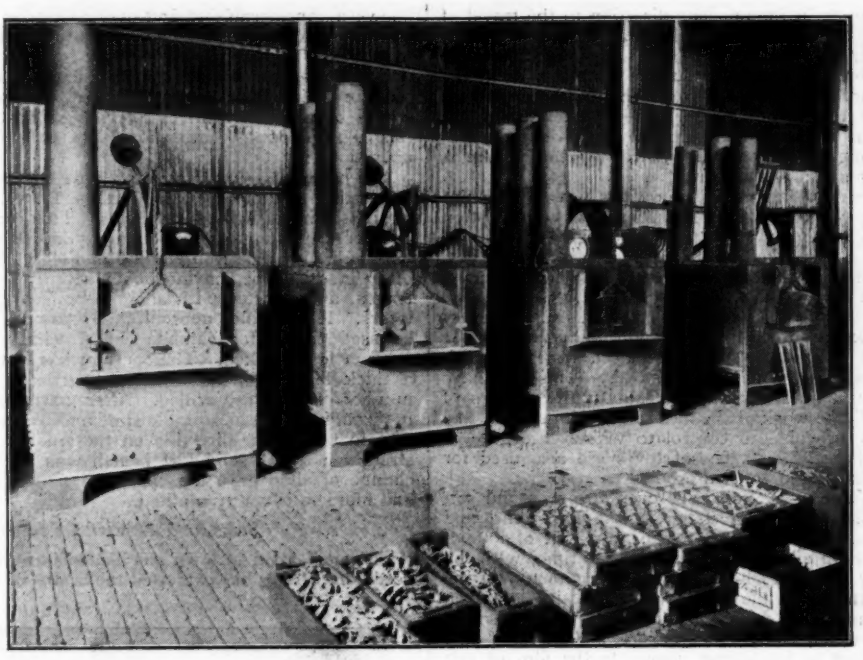


FIG. 1.—INSTALLATION OF HEAT-TREATMENT FURNACES—THE ENFIELD CYCLE COMPANY.

year ended December, 1927, having been supplied to manufacturers for use in trade operations.

The figures of industrial consumption in Birmingham show the development in this direction:

Year ended March 31.	Total Gas Sold.	Total for Industrial.	Industrial P.Ct. of Total.
1911	7,693,899,300	389,511,000	5·06
1914	9,551,783,300	793,840,400	8·31
1918	12,006,496,700	2,680,489,200	22·33
1922	10,264,218,300	1,345,637,300	13·11
1925	12,659,612,900	2,309,976,800	18·25
1927	13,338,[illegible]400	2,605,287,200	19·53
1928	13,581,191,000	2,843,380,300	20·94

Redditch figures show that, in 1927, of a total of 240,533,100 c.ft. of gas sold, 97,098,900 c.ft., or 40·3 p.ct., was for manufacturing operations (apart from power), the increase over the last six years representing 35·9 p.ct.

Special Service.

Several of the large and small undertakings have set themselves out for some years now to give specialized service to the manufacturers within their area of supply; and this has undoubtedly been to their distinct advantage, as will be seen from the figures quoted. The British Commercial Gas Association has assisted both the manufacturer and the gas industry, in its capacity of Central Advisory Bureau, having collected together a vast amount of information on industrial applications for the use of anyone interested. This work needs considerable extension. The larger undertakings may be left to look after their own interests; but in connection with the smaller and medium sized gas undertakings there is great need for an authoritative body within the industry to provide, not only information in written form, but personal specialized advice on the premises of the prospective customer when a particular inquiry is being discussed by a representative of the undertaking. When negotiating for the gas consumption, valuable assistance could be rendered by a specialist in the application of gas to industrial and heat-treatment operations. This service should be paid for, and would be appreciated both by the gas undertaking and its potential consumer.

The author looks forward to the time when an Industrial Gas Sales and Service Organization on the lines of that provided by the Gas Light and Coke Company, South Metropolitan Gas Company, Sheffield, and Birmingham, will be available for any individual gas undertaking, large or small. It is, he said, probable that Birmingham, in its Industrial Research Laboratories, incorporating the Industrial Gas Heating Section, has provided the basis for a scheme which might be adopted with every advantage by the industry as a whole. There have been, and are, opportunities in the Midland city which are not met with everywhere; and the Birmingham Gas Department has taken, and will continue to take, the fullest advantage of those opportunities.

The manufacturers of gas furnaces and apparatus have also taken advantage of the extended field which has been opened to them, and in co-operation with gas undertakings great improvements in individual designs of furnaces and apparatus have taken place.

After discussing various types of furnace, including the "Revergen," which he described as a highly efficient one, Mr. Hems proceeded to give the following details of individual installations:

Gas Furnace Installations at Redditch.

The Enfield Cycle Company, Ltd., are one of the largest consumers of gas for industrial purposes in Redditch; their consumption for 1927 amounting to no less than 27,576,400 c.ft. The general purposes for which gas furnaces are employed are carburizing and steel re-heating operations, for which oven furnaces of standard designs are employed. The Company have also adopted the gas-heated cyanide bath as a means of producing a very thin hard case on mild steel surfaces, as required in the case of free-wheel parts and similar articles. Up-to-date pyrometer control of gas furnaces has been adopted to the fullest extent in these works.

In the cycle and motor-cycle industries, town gas is used, Mr. Hems believes, exclusively for the brazing operations necessary in the building-up of frames. The blowpipe method finds favour among the majority of firms, owing to the ease of applying the pipe to any form of joint. From a gas point of view, the blowpipe, when applied to brazing operations, is admittedly an inefficient piece of apparatus, and the later plan of liquid brazing for jointing offers a more efficient method, although in practice it is only applicable to a brazing shop having a very large continuous output, so that each furnace may be adapted for similar forms of joint. The liquid brazing furnace consists of a special angular plumbago crucible placed into a firebrick setting, also specially shaped. Gas and air blast burner flames are made to play into the combustion chamber round the crucible, until the requisite temperature of the molten solder is obtained. The gas may then be adjusted to maintain the temperature under the required load of joints. Preheating of the prepared joints is usually allowed for in the design of the furnace, to permit of rapid transference to the solder bath.

Few cycle or motor works are without batteries of drying stoves for japanning of frames, mudguards, &c., which, almost without exception, are heated by town gas. The Enfield Company is no exception, one shop alone having a battery of four drying stoves, double-cased, with doors back and front, and complete with trolley and track carriers. Several makers of this type of apparatus have given earnest thought recently to improvement of design; and if a well-insulated casing is adopted, with correct flue arrangements, and a modern type of injector is attached to the bar burner, there should be no excuse for either spoiled work or excessive gas consumption. Of course, a correct thermometer is part and parcel of this equipment; and where refinement of temperature control is required, a thermostat eliminates the human element in any time and temperature operation.

No reference to drying stoves would be complete without mention of the latest forms of conveyor stoves in the designs of which gas is being adopted extensively as the heating agent. They are used for drying in large quantities cycle frames, bedsteads, wheels, printed tin plates, &c. Two methods of heating may be applied. In the one case, gas is burned in a combustion chamber, and a fan is made to project a large volume of air through this chamber and into one end of the drying

chamber itself, usually in the opposite direction to the travel of the articles under treatment, thus allowing pre-heating. The other method is for a series of bar burners to be fixed either in the drying chamber itself or in an outside chamber, as in the case of the ordinary triple-cased stove. This method allows a greater control of temperature over the entire length of the chamber, which, in the case of these conveyor stoves, is generally over 20 ft. long. Thermostatic control of temperature is applied with either method of heating.

The drying stoves for japanning operations already referred to are of the open type, in which products of gas consumption are in contact with the work in progress. The triple-cased stove, in which the products of combustion are passed round the outside of an inner chamber, affords a much more delicate control of temperature, with the abolition of any risk of contamination of the work. This latter type of stove is being used with every success in the works of a local firm of spring manufacturers for the heat-treatment of springs, having replaced with every advantage older types of solid fuel heated stoves. This firm have found, as one would naturally expect, that in the process of manufacture of delicate work of the nature of springs, with this type of oven, they are able to control to whatever degree of temper or colour is required. These stoves are also used for the drying of japans on the finished product.

Messrs. J. H. Yeomans & Son have oven furnaces and salt bath furnaces which are being used for the hardening and tempering of springs. The method of using a salt of known melting point has been widely adopted for some time, with the object of providing a body of heat actually in contact with the articles under treatment, to allow of complete soaking and even heating of steel parts at a definite temperature, with absolute control. Cleanliness of the product is also a feature of this method when applied to hardening, owing to the film of salt adhering to the article preventing oxidation by contact with air during transference to the quenching medium. This firm also use gas-heated drying stoves, a large stove for japanning, and a smaller one for tempering operations.

A local manufacturer producing high-class special needles employs in his heat-treatment shop an oven furnace heated by low-pressure gas, measuring internally 18 in. long by 12 in. wide by 12 in. high, for general hardening operations. This furnace has a gas consumption, when maintaining a temperature about 800° C., of 200 c.ft. per hour (approximate). A small oil bath is used for tempering operations requiring temperatures up to 500° Fahr. This firm speak highly of the satisfactory results which have been obtained with these furnaces in comparison with their old solid fuel methods.

A gas-heated bowl-shaped tank is being utilized in the works of a fishing tackle manufacturer as a salt bath for the blueing of fish hooks. Salts which can be brought to definite temperatures, and maintained as long as required, by the simple adjustment of a gas burner, are used extensively for the production of colour finishes on articles such as fish hooks, pen nibs, small paper clips, shop fitting holders, &c. A considerable diminution in the time required to obtain the necessary colours was noticeable when this method was adopted, as compared with the older way, owing to the " body " of heat in the salt allowing a rapid heat transference to the material to be heated, as it is in contact with the heating medium.

Messrs. Smith & Spencer consume gas in the heating processes necessary in the making of mineral waters. A 30-gallon porcelain vat is used as the main vat for water boiling. This feeds a number of small tanks ready charged with the syrups required for the production of mineral waters. In the design of this boiler full advantage was taken of economies to be effected by suitable insulation, thus reducing loss of heat by radiation to a minimum. The casing consists of a double sheet steel stand, packed with silicate of cotton as a heat insulator. The author was unable to give the actual results obtained with this particular tank; but to illustrate his point, he said that comparative tests which have been made with a solution tank heated by gas, with and without insulated stand, show a saving in gas consumption of at least 25 p.ct. if a suitably lagged stand is used.

Messrs. H. Milward & Co. have installed in their works an oven furnace measuring 4 ft. wide by 30 in. deep by 15 in. high, which is used for the hardening of fish hooks. This furnace has been found in practice to be adjustable to either an oxidizing or reducing atmosphere, as required. Several smaller gas heated furnaces are also installed in these works which, together with the furnace already mentioned, deal satisfactorily with an extremely wide range of small and large articles. In addition, two large gas engines are in use.

The Redditch Re-Rubbering Company have installed a small gas heated boiler supplying steam at the required pressure of 55 lbs. per sq. in. (representing a temperature of 302° Fahr.), which is used in the process of cementing new pieces of rubber into old and damaged new tyres. This small plant is representative of many such installations; and it may be said that there is a very wide field for the use of the small gas heated boiler in place of the cumbersome methods of heating by solid fuel for this and other operations. One much larger installation which the author has had the privilege of viewing, in which a Spencer-Bonecourt gas heated boiler is employed for the generation of steam for the heating of vulcanizing presses, shows a considerable saving over a similar plant belonging to the same Company, installed in another town, which is fed by a solid fuel boiler. The gas boiler is fitted with a thermostat, and is completely automatic. It is fixed in a small cellar in the shop in which the steam is required, in a position in which it would be absolutely impossible to use coal, or probably even oil. The amount of attention given to it in the actual firing operations is practically *nil*.

The Redditch Gas Company have recently constructed an interesting gas appliance for Messrs. H. Wilkes & Co., for the straightening of fishing-rod canes. This consists of a firebrick chamber 4 ft. long, 5 in. wide, and 7 in. high, open at each end, with suitable angle iron binding and legs. The burner is made of 1¼ in. gas tube, having about seventy ⅛-in. holes over 3 ft. length, and is fitted with an injector having gas and air regulators. It consumes approximately 70 c.ft. per hour. It is to be used chiefly for bamboo canes, which when received are more or less crooked. The operator has at the side of the stove a thick block of wood standing vertically, through which a number of holes are drilled. After warming the cane, he puts it through a hole of suitable size, and by exerting a little pressure in the proper direction on the crooked part, he is able to straighten it. A solid fuel hearth was previously used; but a change of shop gave the opportunity of introducing a cleaner and more satisfactory method.

Special Gas-Sealed Furnace.

The application of town gas heated furnaces to the process of needle hardening has exercised the brains of many experts, both in the needle industry and among manufacturers of appliances, for a number of years, as it has been generally admitted that considerable improvements were possible in the methods in use. Special gadget furnaces have naturally been looked upon with disfavour, and many of them have been costly failures —so much so, that it is with a considerable amount of diffidence that a new furnace is introduced. It is assumed that a good design of gas furnace will give heating results equivalent to the coal heated furnace. Several special furnaces have been made introducing containers through which a stream of gas was allowed to pass creating a reducing atmosphere and eliminating oxygen. These have met with more or less success.

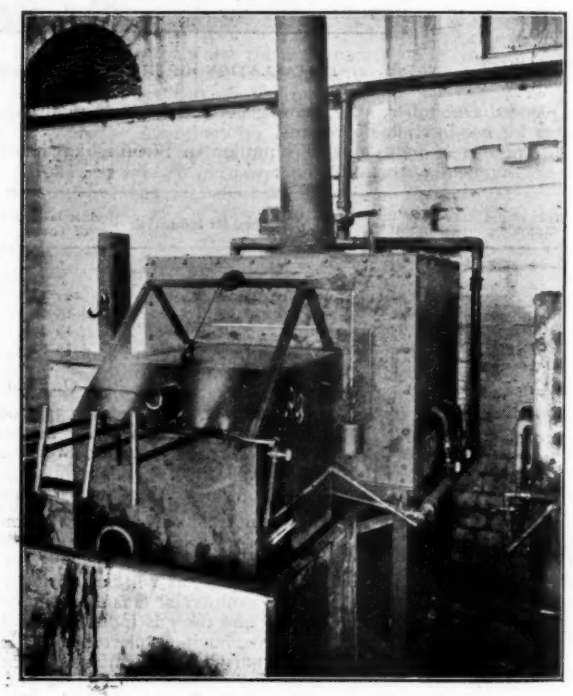


Fig. 2.—Installation of Patent Gas-Sealed Furnace.

In Birmingham they have for a long time realized the high value of a method of heat-treatment of small articles or special steel tools in an atmosphere which provides for the elimination of oxygen, and at the same time affords every opportunity for control during the heating and quenching operations, and even inspection during the heating process.

The special gas-sealed furnace which is now made under licence by the Incandescent Heat Company, embodying the Walter-Palser patents, is the result of investigations into these methods extending over a considerable number of years. The general heating arrangements of this furnace are designed according to the demand which is to be made upon it. For normal requirements of (say) eight-hour day working, a standard natural draught setting with low-pressure burners would be suitable for all temperatures up to about 900° C. in the muffle

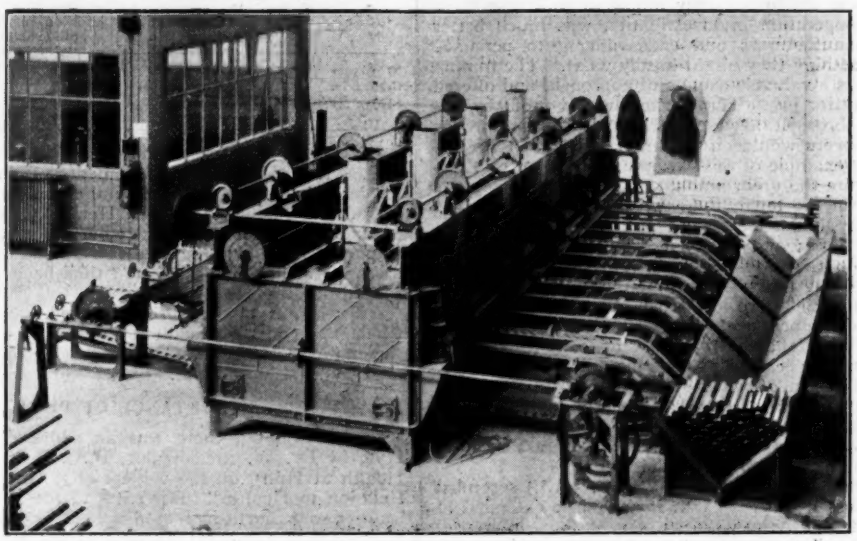


FIG. 3.—OVEN FURNACE FOR HEAT-TREATMENT OF TUBES.

chamber. This chamber, in the smaller sizes of furnace, is made of steel specially treated to withstand heating effects on the exterior, or of special nickel chrome alloy which, in spite of its high cost, justifies itself in many instances. This muffle is extended to the outside front wall of the furnace and flanged. An extension chamber with drop tube into a quenching bath is attached. Provision is made at the front of the extension chamber for the entrance and withdrawal of a rod to carry the work to be treated, with an inspection port and outlet for the sealing gas which has been allowed to enter at a point just above the sealing medium—thus completely filling the muffle chamber and extension piece. Provision for pyrometer thermocouple is made at the back of the muffle chamber.

When the muffle chamber has been brought up to temperature, and the work required to be treated has been inserted, the rod is brought forward; and, in the case of needles, a tray exactly similar to that used in the older types of furnace is placed at the end and pushed into the furnace chamber—the sealing gas being kept burning at the door of the furnace all the time. When the work is soaked at the required temperature of (say) 750° to 800° C., according to the steel used, the tray is withdrawn to a position in the extension chamber directly over the quenching bosh, and turned sharply through an angle of 90° C., allowing the contents of the tray to be precipitated into the quenching medium without, it will be noticed, at any time coming into contact with air.

Experiments with this particular furnace have extended to the heat-treatment of dies of exceptional value; and at the present time a very large furnace on these lines, fitted with a refractory muffle lining, is being installed in a Birmingham works. This method obviates a cumbersome and expensive procedure of packing the dies in boxes to prevent oxidation; and the experiments have proved that hardness results equivalent in every way to the packing method are obtained at a considerably reduced cost, and (as far as finish is concerned) with a highly improved result. The first firm in Redditch to apply this particular furnace to their own productions have developed it to a high degree of success.

Leaving Redditch and its rather specialized applications, Mr. Hems gave some details of metallurgical and general operations which are carried out successfully by means of furnaces or appliances heated by town gas.

Aluminium Melting.

One of the most successful gas heated furnaces for bulk melting is the rotary tilting type, made by the Selas Gas and Engineering Company.

Two of these furnaces are in use in the works of Messrs. F. H. Adams, Ltd., in Birmingham. Aluminium is melted in these furnaces at as low a figure as 7000 c.ft. per ton.

Smaller furnaces for re-melting pots consist of cast-iron cases with interior brickwork linings, shaped and rough cast to the outline of the cast-iron pot used, which generally has a capacity of about 1 cwt. of aluminium. A suitable burner is fixed to play on the under-part of the pot, supplied with gas at ordinary town pressure and air at about 1 lb. per sq. in. or with gas under a pressure of about 5 lbs. per sq. in. In the author's opinion, the latter method is the more satisfactory one from every point of view.

The Birmingham Aluminium Castings Company, Ltd., consumed 138,800,000 c.ft. of gas for year ended March, 1928, in their foundries at Smethwick for these processes. A battery of re-melting pots is also installed at the works of Messrs. F. H. Adams, Ltd. High-pressure gas is used in the last-mentioned installation.

Gas furnaces of the oven or muffle types and salt bath furnaces are used for the heat-treatment of aluminium and also "Duralumin."

Heat-Treatment of Tubes.

A large firm of tube manufacturers in Birmingham have recently installed a new method of steel tube treatment, which is an excellent example of the amalgamation of modern heating methods with mechanical means of handling, which together give a high figure of efficiency for the whole operation. The furnace referred to has a hearth 20 ft. long by 4 ft. wide, and is used for the annealing and heat-treatment of solid drawn seamless tubes in mild, carbon, and alloy steels, mainly for aircraft manufacture. It is the necessarily stringent demands of the Air Board specifications for these particular tubes which have led this firm to instal gas firing for their heat-treatment.

The general practice of handling tubes in length by end-charging methods has many disadvantages. The whole area of hearth cannot be completely utilized, and, in discharging, tubes may be bent and distorted. The suspended crown with which this furnace is fitted is an example of adapting the furnace to the work, instead of the work to the furnace. This, unfortunately, is not possible in every installation, except where continuous and high outputs obtain.

The tubes, after passing through the furnace hearth, are discharged into a sectional V type of cooling trough for final cooling. Firing is by means of natural draught low-pressure gas burners; and a temperature of 850° C. is maintained over the entire hearth within 5° C., and is obtained from cold in just over one hour. A reducing atmosphere is maintained in the working chamber, affording full protection from oxidation to the tube surfaces; and tubes treated are very straight. Gas consumption approximates 1½ to 2 c.ft. per lb. of metal treated at the temperature mentioned. Carborundum is employed for the floor, and full use has been made of insulating material in designing the furnace. Nichrome has been utilized for the detachable link chains which have to pass in and out of the heating zone.

Continuous Annealing Furnace.

There has recently been installed in the works of a Birmingham lamp manufacturer a gas-fired natural draught annealing furnace of the continuous live roller type, for the bright annealing of brass and other non-ferrous pressings. The pressings for treatment under this process are placed in perforated steel baskets, which are put into a small charging chamber at the inlet to the furnace, and passed continuously through the heating zone of the furnace into the cooling chamber, and then through a sealed shoot directly into the quenching tank. A superheated steam atmosphere is maintained throughout the cycle of heating and cooling operations. The pressings when annealed are clean and free from oxide or discoloration, thus dispensing with the cleansing operations usual with other methods of annealing. This plant is dealing with work previously carried out by five gas-fired furnaces of an older type.

Vote of Thanks.

Mr. Rendle, proposing a vote of thanks to Mr. Hems, remarked that what he (the speaker) had intended to deal with had been said at the luncheon and by the author. His desire was to emphasize the need for mutual co-operation of the gas industry and the manufacturers. There was scarcely any works that could not use gas in some section of its operations; and it was surprising to find in what out-of-the-way corners,

and in what unexpected forms, they might come across these opportunities. Co-operation in investigation was much better than going to manufacturers and endeavouring to persuade them to adopt something they might hardly want. The human side of business was a valuable avenue of approach, and offered a great opportunity for gas. The workers would profit by improved conditions brought about by the use of gas quite as much as the employers would on the financial side. Redditch afforded a striking example of the advantages of the use of gas in industry. Despite the great amount of treatment of ferrous metals carried on in the town, there was remarkable freedom from smoke. They had an excellent proportion of industrial gas in their local load; and he must gratefully acknowledge the substantial help they had received from the Birmingham Gas Department. But for this, both the Gas Company and the manufacturers would have lost much that was of value to them. Mr. Hems's paper would suggest to many—even in places not near Birmingham—what vast opportunities might present themselves, and be utilized to great mutual advantage. The careful investigation of works problems had been of the greatest interest and value to them at Redditch, and had revealed the potentialities of gas in many directions. The application of gas was often ignored by manufacturers because they were not acquainted with its possibilities.

Mr. W. M. MASON (Manager of the "B.C.G.A.") seconded the vote, and expressed the wish that it should be extended to all who had assisted to secure the success of the conference. There was no doubt that they must look to gas to bring about a large share of the revival and progress of industry. The industry had no intention of standing still; and the public would never allow it to do so. That day's meeting and visits had turned their attention to new possibilities; and Mr. Hems's fine address—for such it must be termed—was a revelation and a stimulus both to the gas engineer and to the manufacturer. It would provoke the manufacturer to ask questions as to whether gas could not help in his business. Their publicity work was a suggestive education, and a reminder that gas could solve, and was solving, industrial problems. It was foolish to talk of the vague possibilities of new and untried expedients for reviving trade, when they had the valuable assistance of gas ready to hand.

INDUSTRIAL GAS IN COVENTRY.

Mr. F. PYKETT (Coventry) gave some illuminating figures as to industrial gas in Coventry. Their total industrial load, he said, was 40 p.ct.; and they had 42,000 consumers in all. There were 26 of these who were such large users of gas for industrial purposes that he would quote their figures of consumption for the last three years:

—	Total Make. Million C.Ft.	26 Consumers. Million C.Ft.	P.Ct. of Total.
1925	2173	692	31·8
1926	2322	774	33·5
1927	2250	663	29·4

Dr. C. M. WALTER (Birmingham), after congratulating Mr. Hems, referred to the developments of the application of gas for industrial purposes in Birmingham and at Redditch. He said the great interest of Mr. Hems's paper was its revelation of unexpected processes for which gas had been successfully employed. Much of the local success had been due to individual investigation of how gas could thus be used to meet new and special needs.

After Mr. Hems had briefly replied, a vote of thanks to the Chairman and the Redditch Gas Company was accorded, on the motion of Mr. F. C. BRIGGS (Dudley), seconded by Mr. H. DAVIES (Chesterfield).

IMPORTANCE OF PURE AIR.

In the evening, there was an address, in the Temperance Hall, by Dr. W. Allen Daley, B.A., B.Sc. (Medical Officer of Health at Hull), on the subject of "Atmospheric Pollution in Relation to Health." Referring to the harm smoke does, the lecturer said that it increased rickets, stunted growth, and lung diseases. In the rural districts of the East Riding, out of a population of 100,000, the deaths from lung diseases, apart from tuberculosis, were 130 in 1925; but in Hull, out of a population only three times larger, the deaths in the same year from the same cause numbered 785.

In his own house, said Dr. Daley, he had eight gas fires, one electric heater, a gas cooker, and a gas heated wash boiler. He was able by these appliances to save one domestic servant and to use throughout the winter every part of his house. In Hull, in 1926, 4237 new gas cookers and 3732 gas fires were fixed. At the end of that year, the gas cookers known to be in use numbered 33,658, and gas fires 23,152. Still the atmosphere was by no means satisfactory. He dreaded, however, to think what it would be like if all these were replaced by ranges or grates burning soft coal.

Finally, he urged that the gas industry would be doing a great service when, by research and experiment, it could put on the market a smokeless solid fuel that was satisfactory in appearance, price, and heating power, and was made in lumps of uniform size, without an undue proportion of ash. Such a fuel, if it could be started by firewood like ordinary coal, would be worth every effort of research.

LONDON MEDICAL OFFICERS OF HEALTH AT A GAS-WORKS.

VISIT TO THE HEADQUARTERS OF THE SOUTH METROPOLITAN GAS COMPANY.

Coke Fires and the Smoke Problem.

Members of the Metropolitan Branch of the Society of Medical Officers of Health, and their wives, who inspected the laboratories and works of the South Metropolitan Gas Company at Old Kent Road on Friday, May 4.

A party of about fifty members and friends of the Metropolitan Branch of the Society of Medical Officers of Health visited the Old Kent Road Works of the South Metropolitan Gas Company on Friday, May 4. The visitors were met by Mr. Frank H. Jones, Vice-President of the Company, and entertained at luncheon in the dining-room. Mr. Jones presided, and was accompanied by Lieut.-Colonel R. J. Oswald, O.B.E., Chief Medical Officer, and Dr. J. Strickland Goodall, Consulting Cardiologist, and the principal officers of the Company. After luncheon the visitors divided into parties for inspecting the works; and following this they were entertained at tea.

Mr. JONES, in a brief address, pointed out that, though the Old Kent Road Works were not the largest works of the Com-

Dr. F. E. SCRASE, Medical Officer of Health for Hampstead (President of the Metropolitan Branch of the Society of Medical Officers of Health), and Dr. J. FENTON, Medical Officer of Health for Kensington (the Society's Hon. Secretary), examining the new gas coke burning grate at the Old Kent Road Works of the South Metropolitan Gas Company.

pany, they were the nerve centre, or mainspring, inasmuch as they contained the head offices and the laboratories. He reminded those present that the South Metropolitan Company was a co-partnership concern. The guides who had shown them round that afternoon were part owners in the concern, and probably everyone on whom they had set eyes in the course of the tour was a shareholder. There was only one reason that could temper his regret that Dr. Carpenter, the President of the Company, was not present to welcome them, owing to indisposition—that he would not have told them what he (Mr. Jones) was going to tell them. Dr. Carpenter had worked for practically the whole of his life for the Company, and had devoted very much of his time, thought, and energy to the welfare of the workers. Dr. Carpenter, of course, would not have told them that; nevertheless, it was a fact which could be testified to by the whole of the people in the Company.

Smoke Pollution.

Coming to one or two of what he termed "political points," Mr. Jones said:

There is a very close affinity between the work of a gas company and that of the medical officers of health. For years we have been working along parallel lines, if from somewhat different motives, with the object of securing a mitigation of the smoke evil of great cities. It is well known to you all that every year, owing mainly to the burning of raw coal in the open grate, there is discharged into the atmosphere nearly three million tons of solids in the shape of smoke. That pollution is, to us in the gas industry, the symbol of lost opportunities and wasted wealth; to you it is the symbol of needless inroads on the nation's health.

Many of you have doubtless been amused by the correspondence which has taken place in the national Press regarding the declaration by a Canon of St. Paul's that the incrustation of black soot on our ancient buildings, which artists rave about and medical officers deplore, is actually a protection to the fabric of such buildings. Such a statement sets the whole profession of chemists laughing, and brings tears to the eyes of the architect and the builder. But it is not calculated to assist the task of either medical officers of health, who are constantly urging the need of smoke abatement, or of the gas companies, who are, in their way, also a powerful educational force in the matter of purer air.

Smoke abatement is undoubtedly the question of the hour. I notice that even the Budget discussions have largely hinged upon it. We are told that the Budget is going to give a stimulus to the scientific treatment of coal, and induce the nation to burn smokeless fuel. Well, you all know that an experiment in low-temperature carbonization on a large scale is being tried in London; but as the matter is, as it were, *sub judice*, I must refrain from comment on that experiment.

A Coke Revolution.

However, I would like to draw your attention to the very remarkable results that have been achieved by the research laboratories in conjunction with the designing staff of this Company in making it possible for smokeless fuel to be burned in thousands of London homes where the open fire grate has hitherto held sway. We have, during recent months, perfected an appliance which, in effect, solves the whole problem of making ordinary gas coke burn brightly with a lively dancing flame in the open grate. This appliance takes the form of a specially designed grate, the secret of which lies in its complete insulation and draughts which ensure the maintenance of a wonderful state of incandescence throughout the burning period. The coke is lighted in the first instance by a gas burner attachment, and the grate is so designed that it can be fitted to an ordinary chimney with the greatest of ease and at a very low cost. It is now available to the public on ordinary cash terms, hire purchase, or simple hire.

Think what this means! It means smokeless fires, cleaner fires, and cheaper fires to those thousands of people in London who cling to the open grate because they fear that the use of gas for purposes other than lighting or cooking is beyond their means. Every year the works of this Company are making, in addition to their gas output, 750,000 tons of coke. We are serving 414,000 consumers, and we cover an area of 52 square miles of greater London. Think what it means if, throughout a substantial proportion of that area, we can induce people to stop burning raw coal and burn smokeless fuel instead. We are going to try to bring about that reform; and perhaps, in the effluxion of time, you will see evidence of the success of our efforts in a new London of blue skies, clear air, and bright sunshine.

The gas industry has ever been the pioneer of this smoke abatement movement. It holds broad views. It does not fear smokeless fuel as a competitor of gas; it welcomes it, whether in the shape of high-temperature coke or of low-temperature coke, as a future great complementary service of the gas industry, which will enable us to explore markets that would otherwise be dominated by raw coal so long as the open grate remains.

The Welfare Service.

Lieut.-Colonel Robert J. Oswald said that the visitors had seen something of the welfare work of the South Metropolitan Gas Company, including the installation of the electro-cardiograph, which, as they had perhaps already been informed, was probably the first of its kind in any big industrial concern in the country. Up to the present it had proved of immense value. All of them who were medical men would agree that when a man reached the age of sixty-five he was not necessarily "done"—at least he hoped not. Looking at it from the industrial point of view, a man who reached that age had done thirty or forty years' service, possibly of hard, strenuous work which necessarily imposed a strain upon the heart—an organ which was working throughout that period on an average of seventy times a minute.

"We do not say," continued Col. Oswald, "that a man is necessarily past work at the age of sixty-five, notwithstanding the fact that it is a pensionable age. An examination often reveals the fact that there is no serious defect, so he is allowed to carry on, either at his own job or, if we think it necessary, at a job less strenuous. That is a very different thing from turning a man down at sixty-five."

Col. Oswald went on to mention that every man who was

accepted for employment had to pass through his hands. Last year only 3·46 p.ct. were rejected.

Dealing further with the medical side of the welfare service, Col. Oswald said that it had been stated in certain quarters that gasworkers showed a tendency to cancer. A careful examination of their health statistics covering a period of many years had been made, and had revealed the fact that this statement was entirely unfounded.

Coming to the question of industrial fatigue, he remarked that the Company were endeavouring to assist in overcoming fatigue by means of a saline drink. That, of course, was purely a chemical affair. The saline drink was given to the workers in the retort houses, and on the ships, and the advantage was that it restored the saline content of the blood, which was reduced by sweating. There was no abdominal cramp due to the drinking of a lot of cold water. In fact, not a single case of abdominal cramp had occurred since the drink was introduced.

A WONDERFUL ORGANIZATION.

Dr. S. E. SCRASE, the President of the Metropolitan Branch of the Society, on behalf of the visitors, thanked the Company for a most enjoyable and instructive afternoon. He was not going to criticize the Company, he said, because he came that afternoon with certain ideas, all of which had been thrown to the ground. He did not think that medical officers of health were in a position to criticize such works as these, where there were some 8000 workers who were interested in the capital of the undertaking to the extent of £600,000. What had struck him most of all was the wonderful organization throughout the whole works, and the dovetailing of the various parts one into the other. The welfare department was really wonderful. He was sure that it was considerably better than that of many sanitary authorities governing very much larger populations than the works roll of the South Metropolitan Gas Company. Speaking of the electro-cardiograph, Dr. Scrase said that when he saw the evidence of mis-spent youth revealed by that wonderful device, he would like to put one or two of his acquaintances inside. (Laughter.)

Dr. C. S. THOMSON, Medical Officer of Health for Deptford, said that the high standard of scientific attainment reached by that great organization had come as a great surprise to all the medical officers. Their welfare work was marvellous. "We are astonished and charmed by your welfare work," he added, "and it ought to be made known much more widely than it is."

Dr. A. E. THOMAS, Medical Officer of Health for Finsbury, said that the welfare work carried out by the Company was the best he had ever seen. He blamed them, however, very much for not advertising it. He thought it should go forward that the medical officers of health in London were completely satisfied with, as well as amazed by, the wonderful welfare department of the South Metropolitan Gas Company.

Dr. E. G. ANNIS, of Greenwich, expressed the hope that Dr. Oswald would read a paper before the Society on the welfare work of the Company. The South Metropolitan Gas Company had a name as a pioneer in all good works, notably their co-partnership scheme. They were, he thought, the first large commercial firm to apply the principle of preventive medicine to the welfare of their workers, as instanced by the electro-cardiograph, so that they did not run the risk of losing highly-skilled workers when they were advanced in years. The success of that apparatus, he said, showed that when a man reached the age of sixty-five he was not altogether a "crock."

Dr. JAMES FENTON, Medical Officer of Health for Kensington, spoke appreciatively of the Company's welfare work, and expressed the thanks of the Society for a highly educational visit.

Mr. JONES, in reply, said that he would take care that Dr. Carpenter was informed of the good wishes and appreciation of the visitors.

GEORGE GLOVER'S NEW METER WORKS.

The "Ranelagh" Meter Works of Messrs. George Glover & Co., Ltd., Chelsea, which were partially destroyed by fire in May last, have now been rebuilt. In place of the old factory which served for so many years, the new Ranelagh Works now stand ready to carry on the production of those meters which have deservedly gained so high a reputation throughout the industry. The new building (fig. 1) is larger, better designed, and better equipped than ever before. Every modern provision is made for the steady and uninterrupted flow of work from one department to another. From first to last every process in the production of meters is organized, adjusted, supervised, and checked so that the finished job is as near perfection as human hands and modern machinery can devise.

The various floors of the new factory have been gradually occupied as the building operations proceeded, and recently the whole building was taken over.

The official opening of the new building was made the occasion of a visit by the Southern District (Sub-Section "A") Gas Salesmen's Circle, the members of which journeyed to Chelsea on Monday, April 30, to inspect the new premises. Several enjoyable and interesting hours were spent in examining the various processes which go to the making of the Ranelagh Meter. The visitors were received by Mr. Albert Glover (Director and General Manager) and Mr. F. W. Richmond (Director).

STAMPING.

The first department visited was the stamping shop. Here the steel plates (heavily coated with pure tin to resist corrosive action) which constitute the outer casing of the meters are formed and folded or pressed into shape. The powerful machinery which performs this work is on the ground floor, and a row of heavy power-driven presses is kept constantly at work turning out sides, backs, tops, bottoms, &c., in a continuous stream.

CASTINGS.

The adjacent foundry was next inspected, and here all the anti-corrosive white metal parts such as valves, gratings, &c., are cast and sent forward to another department to be hand ground in pairs to ensure smooth working.

BRASSWORK.

The automatic shop attracted much interest. In this department the various component parts of the automatic slot attachment are made and assembled. This work has to be performed very carefully. The mechanism must be easy and smooth to operate without any loose fitting or tight parts. Each component must engage with absolute precision, and be turned out to a standard gauge.

In the next department the ordinary meter mechanism, consisting of indices, wheels, rods, stuffing boxes, connections, cranks, arms, &c. (it is surprising how many small brass parts are needed for the modern meter), is produced and sent forward to the stores.

ASSEMBLING.

The various component parts of the meters are drawn from the new and spacious stores and sent forward to the assembling shops, one of which is shown in fig. 2. The assembling is one of the most important features of the business, and one with

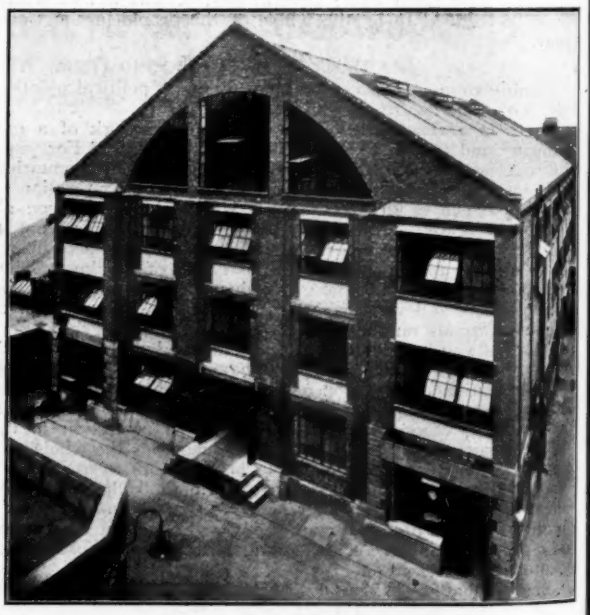


Fig. 1.—The New Building at George Glover's Ranelagh Meter Works, Chelsea.

which the visitors were much impressed. In this department the tinsmiths make the meter cases, and these are then sent to the leather shop (fig. 3) to have the necessary Persian sheepskin leathers prepared for the diaphragm. They are again returned to the large shop shown in fig. 2, where the finishers put in the valves, indices, and automatic mechanism.

THE TESTING SHOP.

The visitors next followed the process of production down to the new proving and testing shop, part of which is shown in

FIG. 2.—THE TINSMITHS' SHOP.

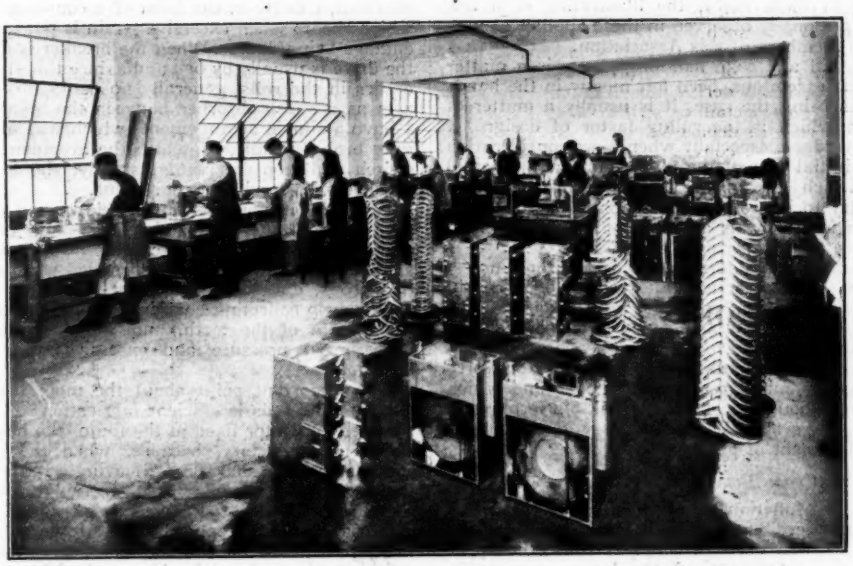


FIG. 3.—THE LEATHER SHOP.

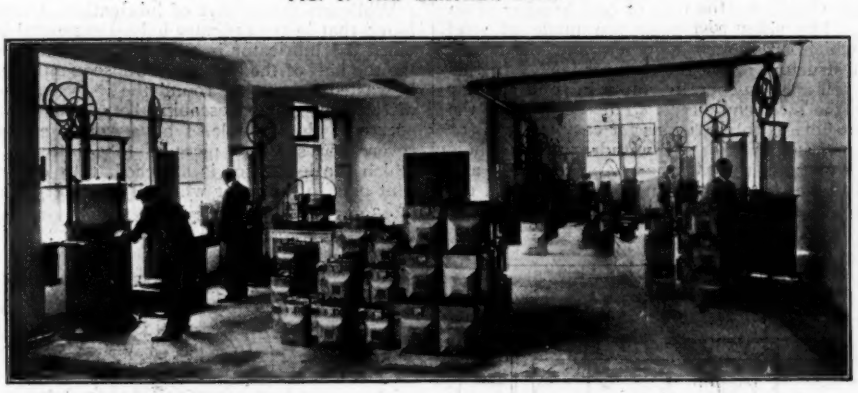


FIG. 4.—PART OF THE TESTING ROOM.

fig. 4. Here every meter is subjected to rigid inspection and tests prior to being returned again to the tinsmiths' shop to have the top soldered on.

OFFICIAL TESTING.

Every meter is, at this stage, sent to the Gas Meter Testing Station of the London County Council and tested in accordance with the latest Board of Trade Regulations as well as at higher pressures—namely 12 in. for soundness, and 3 in. for registration with the outlet fully open—so as to ensure correct registration at varying rates of consumption and pressures of gas, and to prevent "slow" registration even if the meter is over-worked.

PAINT SPRAYING.

When the meters are returned, they are transferred to the paint shop, where the familiar red coat is imparted by means of sprays. Each meter now emerges spick and span with its scarlet exterior, with every internal part made with engineering precision, and tested and proved correct in every working part. They are sent forward to the packing and despatch department, each meter destined to give many years of faithful and reliable service.

Before adjourning to the works canteen for tea, the visitors were shown over the extensive repair shop, to which "veteran" meters are returned to be given a new lease of life in the service of gas.

Mr. W. P. TUCKER (Wokingham), the Chairman of the Circle, thanked the firm for the opportunity of inspecting the interesting processes of meter manufacture. It had come as a surprise to many members to learn how many separate parts a meter contained. This showed the necessity for the accuracy in manufacture and assembly which they had seen demonstrated that afternoon.

Mr. A. W. GLOVER, in reply, said they were always glad to see visitors at the factory; and they welcomed inspection in all departments, feeling certain that personal observation would strengthen the confidence which had existed for so many years between their customers and themselves.

NOTES ON THE DESIGN, MAINTENANCE, AND WORKING OF COAL AND COKE HANDLING PLANTS.

By Mr. W. L. Robertshaw, of Sunderland.

[Paper before the North of England Gas Managers' Association, Newcastle-upon-Tyne, May 4, 1928.]

When our Secretary asked me at very short notice to give a paper for this meeting, I felt inclined to put him off with a promise of one at a later date, which would allow me more time to gather together the necessary information and to make plans, diagrams, &c.; but as I did not wish to disappoint him, I decided on the above subject, which I could cope with in the time at my disposal.

Coal and coke handling plants have become an indispensable part of the equipment of a modern medium-sized gas-works, and consequently there is a necessity for engineers to acquire a thorough knowledge of the construction and working of these plants. I am therefore of the opinion that, among other matters referred to in these notes, the illustration of a few weak points I have personally observed in these appliances may be of interest to the members of this Association.

The designing of coal and coke handling plants is a matter which has, with some exceptions, been left mostly in the hands of contractors. This being the case, it is usually a matter of competition in price which is the ruling factor of design. I believe this can be overdone, especially when more consideration is bestowed on the initial cost of the plant than on the actual design—a method which gives little or no encouragement to those makers who try to improve their standard of work, and who make provision for renewals and repairs being done with as little inconvenience to the user as possible.

When selecting plants such as form the subject of these notes, I am of the opinion that too much time cannot be spent in studying the detailed drawings, especially with regard to the arrangement of all parts for easy access and renewals, lubrication, &c., as only those who have had experience of troublesome coal and coke handling plants know the amount of worry they involve. All points out of reach from the ground which require any attention should have substantial platforms and ladders, so as to give every facility for easy examination, lubrication, and replacement of parts.

Coal Breakers.

We all know that the function of a coal breaker is to break the coal to a suitable size. To do this, it is necessary for the breaker to be fitted with two sets of claws or rolls; the upper ones breaking the large lumps, and the lower ones again breaking the coal to the finished size.

Fig. 1 shows a side elevation of a type of coal breaker often used in gas-works. The sides and body are made of steel plates and angles which are bolted together, and the whole rests on a steel joist structure above the elevator boot. In this type of breaker the roll shafts generally rotate in solid circular filbows bolted on to the steel end-plates. This design has the great disadvantage of having no provisions for easy renewals or repairs; and before any roll shaft can be withdrawn, the whole of the gearing which operates the rolls has to be removed, and the structure pulled to pieces, which is an unnecessary and expensive piece of work.

My ideal of a coal breaker is such that the above difficulties should be anticipated by the maker, and the breaker so designed as to allow of the removal of all working parts without undue interference with the structure. My experience is that the bottom rolls should be arranged to be capable of easy removal and replacement, because it is in these rolls and shafts that we find the most wear, owing to the fact that they rotate about four times as fast as the upper ones, and pieces of iron, stone, wood, and other foreign matter accidentally delivered with the coal (and which generally pass the upper rolls) get jammed between the closer lower ones.

In the event of the coal breaker being driven direct by a steam engine and gearing, a safety device should always be provided, usually in the form of a coupling with one bolt only, which shears when excessive strain is put upon it, and prevents damage being done. When the breaker is driven by electricity, the drive is usually by belt; and since this slips when a stoppage occurs in the rolls, generally no damage is done. A belt also acts as a shock-absorber between the breaker and the motor. I have a simple arrangement, which was made out of an ordinary broom handle, by which the attendant can throw out the switch and stop the plant instantly, should a blockage of the breaker with foreign matter occur.

I am of the opinion that all claws and gear wheels on the four main breaker shafts should be made of steel, and that on no account should chilled cast-iron be used. The gear wheel should not be shrouded, for shrouded wheels in such places are dangerous, due to the fact that the grease used on the teeth cannot help collecting coal dust, which will accumulate hard in the bottom of the teeth, and, being difficult to remove, will cause great pressure and excessive wear and tear on the bearings.

One important point about the main bearings of the shaft carrying the rolls is efficient lubrication. There is generally a Stauffer lubricator fixed at the top of the bearing. This I have found unsatisfactory, because, when the gunmetal bush becomes worn, the shaft drops, leaving a space through which the grease escapes, instead of being carried down to the point where pressure is greatest. I have now arranged for the application of grease to these breaker bearings to be made at a point in the lower part of the bearing, which ensures that the shaft always gets a good supply of fresh grease. This arrangement, which is shown in fig. 2, I have found a complete success.

While on the subject of lubrication, I may say I have often found that in the ordinary halved gunmetal bearing or plummer block the lubricator is screwed only into the cast-iron cover of the top half of the bearing. Consequently most of the lubricant is wasted by passing round the recess at the back of the gunmetal bearing, and escaping between the cover and base. To overcome this trouble, I always bore a clearance hole in the cover, and screw a piece of tube into the gunmetal bush to which the lubricator is attached, thus ensuring that the lubricant gets to the point where it is required. This is detailed in fig. 3.

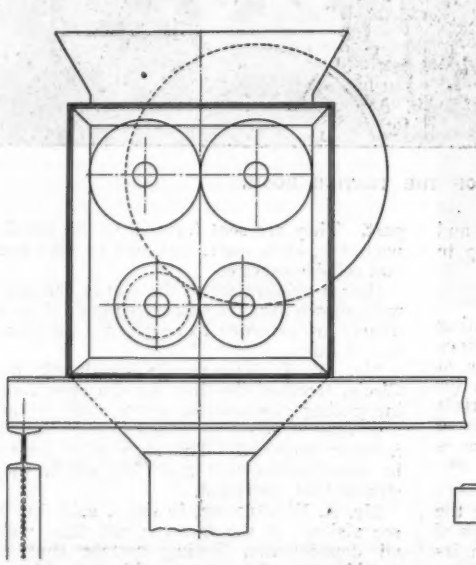


Fig. 1.

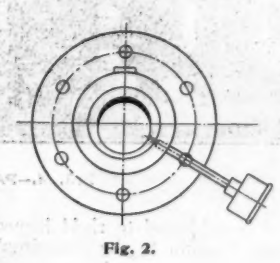


Fig. 2.

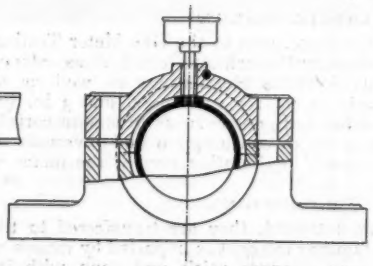


Fig. 3.

COAL ELEVATORS.

Careful study of the working time of all classes of machinery may result in the saving of a great amount of wear and tear and labour costs, which, expressed in pounds, shillings, and pence, would soon be a considerable amount. For instance, what proportion does the running of coal elevators on full load bear to the time taken in running on part load or empty? How often are elevators working with buckets barely half full of coal? Ask yourself the reason. Is the elevator running too quickly or is the coal feed too slow?

Coal elevators are put in as labour-saving devices, but a great deal of money can be spent on repairs, due principally to the want of foresight by the man in charge. If with the same elevator you can lift more coal while running at the same speed, it should be done, rather than increasing the speed of the elevator for the same object.

As a case in point, I had an elevator under my charge which was a constant source of trouble. It was constantly getting blocked up, and still was only doing at its best about 60 p.ct. of the work it should do. Even to do this the driving belt had to be kept excessively tight, which caused considerable wear on the bearings; and it had a very bad habit of always wanting special attention at week-ends. Upon investigation I found that the two main causes of my trouble were as follows:

(1) The driving belt of the elevator was not travelling at sufficient velocity to do its work without being unduly tight. This was remedied by increasing the diameter of both the driving and the driven pulleys (which were both of the same diameter) from 21 in. to 32 in., which increased the belt velocity by 50 p.ct. Since this alteration has been completed, the belt works slackly, has never come off, and the friction on the bearings has been greatly reduced.

(2) When the jigger feed was feeding the coal breaker at its full capacity it overfed and choked the elevator. Consequently it was worked at about three-quarter stroke, the buckets going up about three-quarters full; but, if a fine run of coal came through the breaker quickly, it would suddenly block the elevator boot. To avoid these blockages, the attendant would still further reduce the breaker feed, and consequently take considerably longer to get his coal up for the day.

To overcome these difficulties, I decided that the capacity of the elevator should be increased, so that with the jigger feed full open no possibility of a blockage of the elevator boot could take place. The following three methods of increasing the delivering capacity suggested themselves:

(1) To increase the speed of the elevator.

(2) To replace existing buckets with others of large capacity.

(3) To fix additional buckets of the same size as the existing ones.

No. 1 method was turned down because of the excessive wear and tear which would occur as a result of the increased speed.

No. 2 method was found to be useless, as there was not sufficient clearance for larger buckets.

No 3 method was adopted because it was the most practical way of overcoming our difficulties.

The 94 original elevator buckets were attached to a 6-in. pitch twin chain formed of links, steel pins, and cast-iron rollers; a bucket being attached to every third link at 1 ft. 6 in. centres. By adding 47 additional buckets, which made one bucket on every alternate link, the centres of the buckets were thereby reduced to 1 ft., and the delivering capacity of the elevator increased by 50 p.ct., though still running at the same velocity. As the elevator has a considerable lift (about 70 ft. centres) and there was a considerable increase in the load carried by the top sprocket shaft, I replaced the existing shaft with one of larger diameter, so as to deal safely with the increased load.

Having only one elevator to deal with the whole of my coal, I had to carry out the above alterations day by day as time would allow, and I arranged to change about 16 ft. of complete chain and buckets daily until I had fixed all the buckets at the closer pitch.

Since these alterations have been completed, the elevator has worked satisfactorily and is now doing in five hours the work which previously took seven-and-a-half to eight hours. This alteration to the elevator cost £42 for material and labour; and as we handle over 25,000 tons of coal per annum, the cost of the alterations was saved on attendants' wages alone in under twelve months. I may say that, though the nominal capacity of the plant was twenty tons per hour, we seldom got more than fourteen tons delivered into our overhead hoppers. After the alterations were completed, twenty-two tons per hour was often exceeded.

COKE HANDLING IN A MEDIUM-SIZED WORKS.

Hot coke conveyors of every type and construction have been tried for the purposes of conveying coke from the retort house to the yard; and to describe them and compare their merits would be a formidable undertaking. Broadly, they may be classified under the general headings of carrying and dragging conveyors. I will, however, confine my remarks to one of the De Brouwer drag link type; this having held its own by reason of its low operating costs, in spite of its extremely low mechanical efficiency and high maintenance costs.

From a maintenance point of view the fewer working parts there are about a conveyor the better, but all parts should be easily accessible and renewable under normal working conditions with the least possible inconvenience.

When I took charge of my present works nearly fourteen years ago, the hot coke conveyor was showing unmistakable signs of wear and tear, and it was seen that it would require a thorough overhaul at an early date. Though this would have been a comparatively easy matter in a large works, where one can arrange to let down a whole retort house at a time, in my case it meant discharging the whole of the coke on to the floor and barrowing it out into the yard—a most expensive arrangement. I therefore decided to carry out the repairs during ordinary working hours.

Our normal method of working the retorts is 12-hour charges and three shifts per twenty-four hours; the coke being discharged every two hours. To give sufficient time to carry out the repairs, I arranged to work an afternoon and night shift only, the first discharge of each shift taking place at 1 a.m. and 1 p.m. and the last at 7 a.m. and 7 p.m. respectively. This gave the period from 7.30 a.m. to 1 p.m. daily to undertake repairs. I may state this arrangement worked very well, and that during the period of repairs the whole of the coke produced was handled by the conveyor.

Before commencing the work, I saw that all the material required for the repairs was on the site, and we then proceeded with the work in the following manner, commencing from the tension end of the conveyor in the retort house. One section only (14 ft. 6 in. length of trough) was tackled daily. The two inner lining plates with guiding angles riveted to them were first removed. The chain was then slackened and lifted clear of the trough, which allowed the cast-iron bottom plates to be removed. The remaining shell of the trough was then thoroughly cleaned and was coated with non-oxidizing paint. While this was being done, the angles were stripped off the lining plates, and new angles and 9 in. by ¼ in. rubbing strips were marked off from the old ones, and all holes drilled. When all these were ready, new bottom plates were placed in the conveyor, the chain was lowered into position, and the side lining plates, rubbing strips, and guiding angles were assembled in their proper places and all bolted together. This having been done, the conveyor was ready for work again. The above procedure was carried out until the whole seventeen sections had been repaired, which was done in under three weeks by working during mornings only.

A part section through the conveyor trough in its original form is given at "A," fig. 4; the worn portions being clearly shown. "B," fig. 4, shows the trough after repairs. The additional 9 in. by ¼ in. rubbing strips will be noted.

In 1920, when we increased the carbonizing capacity of the works by 50 p.ct., it was necessary to extend the conveyor.

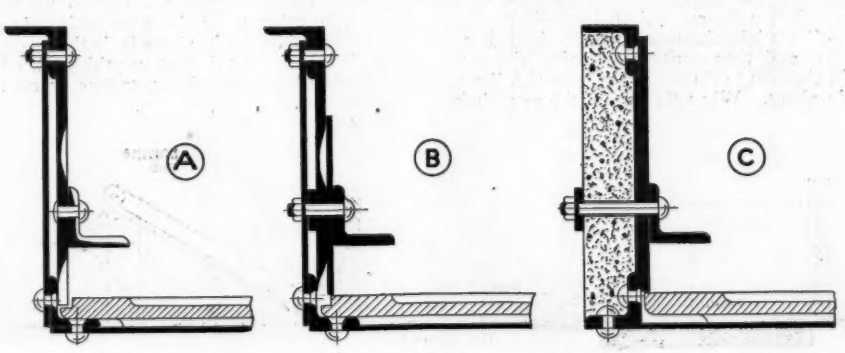


Fig. 4.

Owing to excessive corrosion of the trough, we decided to renew it for the whole of its length inside the building at the same time that we extended the conveyor. In this case we re-designed the trough to facilitate running repairs, putting material where it was required for wear, and making all wearing parts easily removable by using bolts instead of rivets. We also further protected the trough by means of concrete, all as shown at " C " in fig. 4.

As no doubt several members have similar plant, I give below particulars of the life of the various chains we have used since the conveyor started, up to April 30 last.

Hot Coke Conveyor Chains

Record of Life.

Chain Number.	Length of Chain.	Reason for Replacement.	Months in Actual Use.	No. of Link Pitches Removed.	Tons of Coke and Breeze Handled.	Total Cost of Chain.	Cost per Foot Run.	Cost per Ton of Coke and Breeze Handled.
	Ft.					£	s. d.	d.
Original .	390	Broke	34	14	52,400	198	..	0·91 (1·13)
1st replace	390	Broke	36	17	43,500	198	10 0	1·09 (1·36)
2nd replace	390	Broke	32	17	41,744	225	11 6	1·29 (1·61
3rd replace	390 (See note C)	Breakage anticipated (see note A)	28	17	42,102	369	14 9	2·11
4th replace	500	Breakage anticipated (see note B)	28	18	49,500	425	17 0	2·07
5th replace	510	Broke	27½	18	50,500	289	11 4	1·37
6th replace	500	Still in use	27 to date	16 to date	42,100 to date	244	9 9	1·39 to date

(A). Removed during coal strike, July 4, 1921. (Did not wait for breakage.)

(B). Removed in October, to avoid breakdown on winter load.

(C). 500 ft. of chain ordered and paid for, but balance of 110 ft. not brought into action until June, 1910, when the conveyor was extended.

Note.—Owing to increase in the length of chain from 390 ft. to 500 ft., the cost per ton of coke and breeze handled has increased in the proportion of 5 to 4. Therefore, for comparison, the cost per ton for the original, first replacement, and second replacement chains should be increased to 1·13d., 1·36d., and 1·61d. respectively, as shown in brackets.

From the above figures you will see that the sixth replacement chain has handled, up to April 30, 42,100 tons of coke. Judging by the present condition of the chain, I have every confidence that it will last until some time in October of the present year, when it will again be replaced. By that time it will have handled well over 50,000 tons of coke, and the cost per ton of coke handled will have been brought down to 1·16d.

As generally one side of the chain stretches more than the other, it is necessary periodically to cut out alternate sections (about 17 ft. long), and reverse them; also, when the chain becomes too long, to remove a crossbar and links which form a complete pitch of 2 ft. 1½ in. It is my experience that, after the seventeenth complete pitch has been removed, the chain may give way at any time.

Owing to the uncertainty of knowing when a chain will break and " let you down," it is always desirable to carry a spare length in stock, and in such a position that it can be brought into commission at very short notice.

As our C.W.G. plant is placed in the retort house in close proximity to the tension end of the conveyor, it is impossible to lay out the new chain in a suitable position on the floor. To overcome this difficulty, we have constructed a trough approximately 30 ft. long by 3 ft. wide by 3 ft. 6 in. deep covered with chequered steel plates. The new chain is placed in this trough in readiness for an emergency, and by means of a system (which I think is unique) can be brought into use in about two-and-a-half hours. Fig. 5, in conjunction with the following description, illustrates how the worn-out chain is replaced.

First we cut the old chain at the point " A " at the bottom of the slope of the return outside the retort house, then slowly run the conveyor, throwing the chain off into the yard as it slides down the incline. When the cut end of the chain reaches the tension end at " B " we join the new chain to the old one by means of two bolts, and then continue running the conveyor very slowly, still throwing off the old chain at " A " and drawing the new chain along. When the end of the new chain reaches point " A," it is disconnected from the old one, and a wire rope is attached. This is threaded along the return track in the retort house, and, passing over temporary pulleys " C," is coupled to the new chain in the trough. This is shown diagrammatically in fig. 5. The conveyor is again started, and the wire rope drags the new chain along the retort house until it reaches the tension end, when the rope is removed and the two ends of the new chain coupled together.

During the early part of the war our coke stock increased at a rapid pace; and as we could not then stock more than 500 tons without trimming, I put up the gantries shown in the two photographs, and arranged for 40-c.ft. tip wagons to run on a 24-in. gauge light railway fixed thereon. By this arrangement we are now able to stock up to about 1500 tons of coke comparatively cheaply. The gantries were war-time products and were built up of second-hand joists, channels, &c.; the trestles being made from old double-headed rails.

Photograph " A " shows the hot coke conveyor emerging from the retort house and delivering coke to the first section of gantry during the erection of the second section. It will be observed that the framework of a shed is being erected over the electric motor and machinery at the conveyor head, to house them and to facilitate repairs in bad weather.

Photograph " B " shows the above-mentioned gantry and shed completed. It will be noticed the gantry is so arranged that, from any point along its length, coke can be tipped into the yard.

At the point where the man is standing with the tipping wagon on the gantry, there is fixed at right-angles to it another gantry; and by means of a turntable the tipping wagon can be diverted along this second gantry, and its contents deposited in the hoppers below, or can be taken still farther round the curve, where will be seen in the background the tipping wagon with a man in attendance. This man tips the coke out of the wagon on to a floor (20 ft. above the works yard level) where it is very conveniently situated for trimming into the storage hoppers for supplying the transporter wagons referred to later in this paper.

The coke shown on the floor at the right-hand side of the photograph, below the main gantry, can also be easily trimmed into these storage hoppers when required.

Coke Handling Plant to Railway.

Owing to the geographical position of the works, the railway sidings are 50 ft. above the works yard level; and the only method of getting coke into trucks on rail, at the works, is to elevate it by some means.

Previous to 1920 the whole of the coke which was sold on rail either for shipment or land-sales had to be filled into trucks at a goods station (one-and-quarter miles away) by carts or motor-wagons. It was a very costly and unsatisfactory arrangement, the maximum quantity that could be dealt with daily being about thirty tons. However, when the coal gas plant was increased to its present capacity (in 1920), it was definitely decided that something should be done to enable us to put the coke direct into trucks at the works; for owing to the increased amount of coke to be handled and the high cost of handling, it was absolutely impracticable to deal with it by the old method of motor-wagons or carts to the station.

A telpher scheme with self-filling skips was at first suggested; but this was ruled out of court, as it would not have been a paying proposition, since the saving would not have been commensurate with the high capital expenditure involved.

During a visit to a cotton mill in Lancashire I saw an electric transporter made by Messrs. Herbert Morris used for hoisting bales of cotton from barges in a canal, and depositing them in the warehouse. This gave me the idea for a similar arrangement for handling coke at our works. Messrs. Herbert Morris were asked to quote for an electric transporter capable of hoisting a 30-cwt. gross load, with a vertical lift of 63 ft., at the rate of 60 ft. per minute, in accordance with the arrangement set out by us and illustrated in outline in fig. 6. Details were submitted for our approval, and with very few modifications the work was put in hand; the method of working being as follows:

From our coke storage hoppers we fill self-trimming side tipping wagons (see fig. 7) each holding approximately one ton of coke. These wagons are pushed by hand along a 24-in. gauge light railway for about 70 yards. At right-angles to this railway, but fixed 70 ft. above it, is the transporter track. This track is so arranged that anything lifted from it may be deposited either into railway trucks or on to any of the platforms shown.

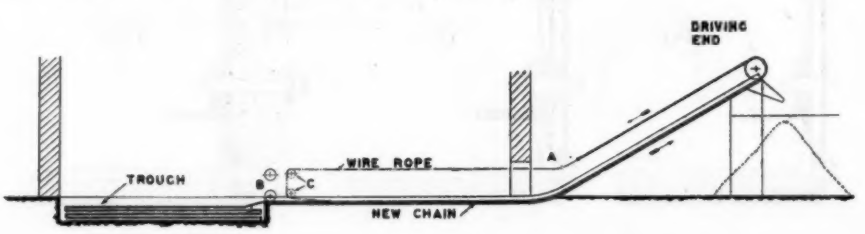
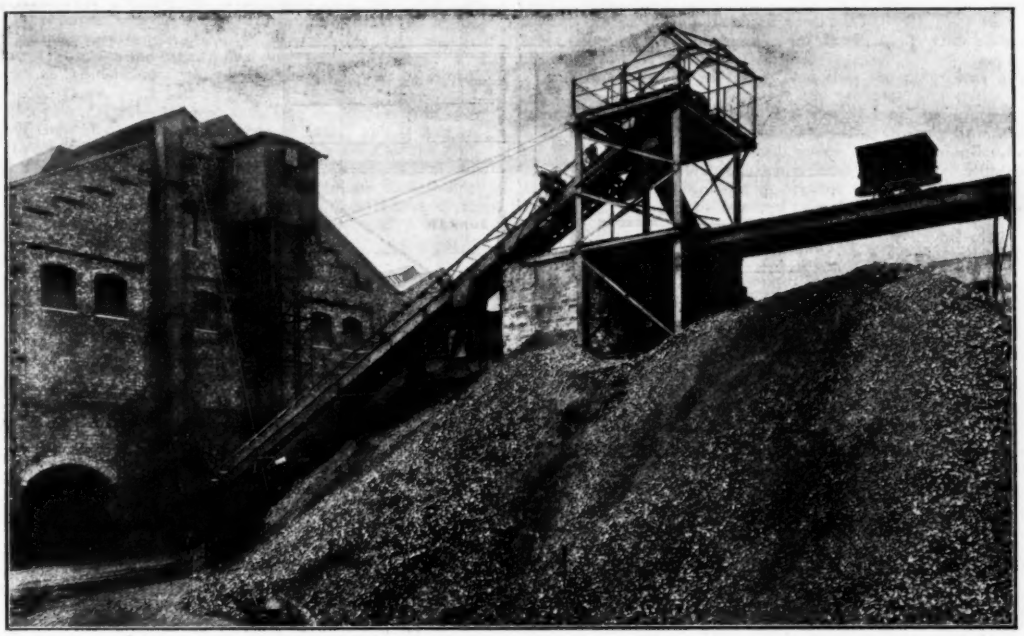


Fig. 5.



Photograph "A."

The transporter is operated by a man situated in a fixed control cabin "E" above the level of the trucks, from which he can see the side-tipping wagon in position "A" at the ground floor level, and, at the higher level, the trucks ready to be filled. By means of a suitable lifting bale, which is hooked on to the trunnions fixed on to the ends of the coke wagon bodies, the latter are lifted from their carriages a height of 63 ft., through an opening in the retort house roof, and then travelled horizontally above the trucks to position "B." A catch is then released. The body rotates, and deposits the coke in the truck.

By this means we are able with five men to load ninety tons of coke per normal working day (8½ hours). This is more than treble the amount which we ever put on rail in the same time at the goods station, where the accommodation provided by the Railway Company was inadequate for our purpose.

This transporter has proved invaluable, and since it has been installed it has been used for the following purposes in addition to coke loading:

(1) Loading spent oxide into trucks, as shown at "B."

(2) Hoisting retort resetting material from the yard level, and depositing it on the platform at top of bench, as shown at "D."

(3) Lifting coke to overhead hoppers which supply the producers of the coal gas plant and the generator of the water gas plant, as shown at "C."

(4) Transporting coal during the coal strike from the store to the ferro-concrete receiving bunker "F" situated above the coal breaking machinery.

(5) Lowering goods received by rail to the yard level.

In case of an elevator breakdown it can also be used for removing coal from the store into the overhead coal hoppers above the retorts, as shown at "C."

As this scheme may be of interest to some of our members, I give some particulars of the cost of the plant, the cost of working, and the material it has handled since it was put into operation.

Photograph "B."

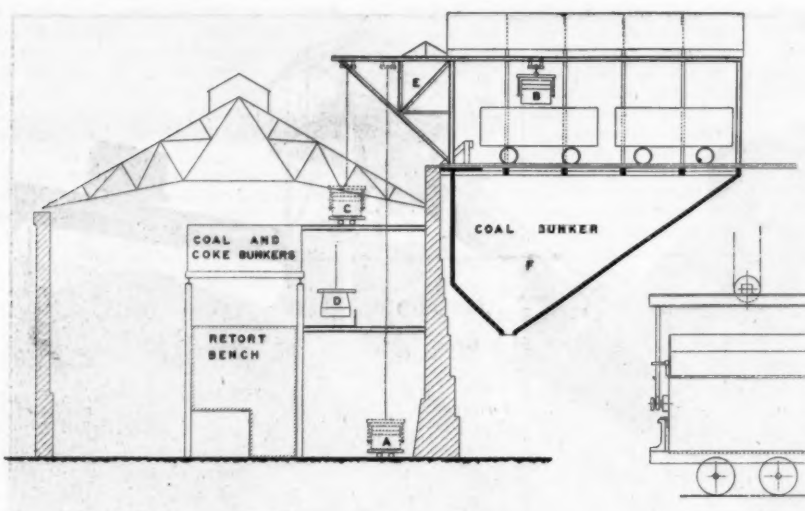


Fig. 6.

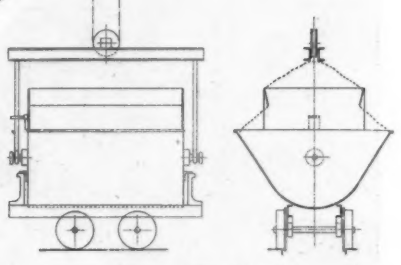


Fig. 7.

The cost in 1920 of the whole scheme for transporting coke, &c., was:

	£
Transporter	965
Alterations to coal-receiving shed roof, cables, retort house roof, platforms, &c.	335
Light railway at ground level, two tipping wagons, &c.	100
Total	£1400

The total amount of material handled by the transporter since it was installed in September, 1920, up to and including Dec. 31, 1927, was 34,250 tons.

We normally handle by the transporter about 5200 tons of coke per annum; the amount so dealt with being slightly more than 50 p.ct. of our total sales. The cost of handling is as detailed:

Cost of Coke Loading on 90-Ton per Day Basis.

	Pence per Ton.
Labour, 5 men at 9s. 8d. per 8½-hour day = £2 8s. 4d.	6·44
Electricity, 1/7th unit per ton	0·14
Spares to Dec. 31, 1927, £13	0·09
Seven new hoisting ropes, £26	0·18
Interest and depreciation (say, 10 p.ct. on £1400) based on 5200 tons per annum	6·46
Total cost per ton	13·31

As our contract rate for carting to the goods station was 3s. per ton, the saving per annum on a 5200-ton basis amounted to £492. Thus, as the plant cost £1400, it paid for itself in under three years.

I trust that these particulars which I have placed before you will be of interest to the members of this Association, and will provide matter for a good discussion.

Discussion.

Mr. A. C. Hovey said that he had not addressed the members of the Association for some years; but just a quarter-of-a-century ago he had read two papers to the members which included the description of stoking and other machinery in some new gas-works, and the effect that machinery had upon the working results.

Mr. Robertshaw had been generous in expressing the opinion that the designing of coal and coke handling plants should be left largely to the contractors. The general arrangement usually came from the gas engineer; but he agreed with Mr. Robertshaw that the details of the design of machinery should be left to the contractors. A large firm had constructed many hundreds of breakers, elevators, and conveyors which were in daily operation and had to give reliable and full load service. Gas engineers had, however, suggested where improvements could be made; and since the earlier inventions of pioneers of machinery such as West, Foulis, and De Brouwer, machinery had come to be regarded as essential for the economical production of gas and as a faithful servant. In deciding the margin of safety and the amount of bearing service, care had to be exercised to avoid excessive weight; but he thought the drag conveyor was now out of date, and that the material should be carried by buckets on rollers or by belt. Coal breakers were now usually of two types. The disintegrator type for large throughputs was cheap and useful in certain circumstances, but it practically pulverized the coal, which was disadvantageous to carbonization. In large retort houses over one hundred tons of coal per hour entered, and either the disintegrator type must be adopted, or a pair of breakers of the claw class. Mr. Robertshaw had effected some very economical repairs, and at the same time had increased the capacity of his plant. In one instance he had been able to increase the load 50 p.ct. by an outlay of £42. Attention had been directed to the economy and long life secured by efficient lubrication; and the suggestion of the introduction of the lubricant to the bearing surface below the horizontal centre line was useful. Immediately prior to the time he (Mr. Hovey) had described the new works he had mentioned, he had been responsible among other duties for the supervision of a retort house containing twenty-four settings of horizontal through retorts, some of which were operated on the basis of five charges every twenty-four hours. He had inspected Mr. Robertshaw's work a few months ago, and he was much impressed by the cleanliness and orderliness of the works, and the way in which machinery had been adapted to the special requirements of the site. Mr. Robertshaw's enthusiasm, and the evident pleasure he enjoyed in the work he had done and was doing, made a visit to his works of a happy character; and what had been accomplished was befitting of a lieutenant of his Chief and their admirable friend and colleague, Mr. Drury.

Mr. J. E. Blundell (Carlisle) said he would like to congratulate Mr. Robertshaw on the excellent manner in which he had got over the difficulties he had to contend with. He seemed to have made the best of a difficult situation, and the financial result had justified the selection of plant he had installed. The paper was one of extreme value to the gas industry. The question of coal and coke handling plant was of great importance, and presented a problem to every gas engineer. The size of works, the method of coal carbonization, the amount of space available, &c., made the question a local one. With reference to coal handling plant, he agreed with the author of the paper that the claws of the breaker should be made of cast steel, and that all shafts should be easily removable without disturbing the structure. The coal breaker at Carlisle, erected by Messrs. West's Gas Improvement Company, was a breaker of this type. It had been in constant use for upwards of six years, and had worked very satisfactorily—repairs being almost negligible. With reference to coke handling plant, as members of the Association were aware, the whole of the coal at Carlisle was carbonized in continuously-operated vertical retorts, which simplified the question of plant, there being no hot coke to deal with. The coke was discharged from the retort into a West lip bucket conveyor; and he would like to state that this conveyor had been the most satisfactory piece of machinery erected at the works. A great advantage of this type of conveyor was that it could be fed without any form of mechanical filler whatever. The length of the conveyor was 570 ft., the number of lip buckets 244, the unladen weight 20¼ tons, and, when fully loaded with coal, the weight was 25 tons. The conveyors were electrically driven, and the current used equalled 0·19d. per ton of coal handled, with electricity at 1d. per unit. This, he thought they would agree, was very satisfactory. He could not give the cost of the renewals, chiefly because these were so small. So far, no repairs had had to be undertaken due to wear and tear, with the exception of replacement of rollers—a small item. There certainly had been some expense on the coal bunkers, as the steel plates did not last too long. This difficulty had been overcome, as the bunker has been lined with easily renewable cast-iron plates. It might interest the Association to know the wages cost of combined coal and coke handling plant. These comprised:

One coal plant man, 47 hours per week at 1s. 3d. per hour	£2	18	9
Three crane men, who also looked after coke conveyor and skip filler, 7½ shifts each per week at 10s. per shift	11	5	0
Being a total in weekly wages of	£14	3	9

Both the coal and the coke handling plants at Carlisle had been in constant use since September, 1922; and during that period approximately 30,000 tons of coal and between 19,000 and 20,000 tons of coke had been dealt with annually. The success or failure of coal and coke handling plants depended very largely on supervision. With moving machinery conveying materials such as coal and coke, it paid to watch things very closely. The question of lubrication alone, if properly attended to, would ensure smooth working and prolong the life of the plant. When the conveying plant was installed, lubrication was by hand, by means of a grease gun which forced oil into the rollers. This had since been superseded by a chain-driven lubricator. It had four copper drip pipes so situated that the oil dripped on to the chain as it was descending, thus giving a thoroughly satisfactory lubrication to the essential portion of the plant. The quantity of oil used was approximately half-a-gallon per day per conveyor.

Mr. G. E. ANDERSON (Willington Quay) said that their difficulty in discussing the paper was that the information dealt with Mr. Robertshaw's own circumstances.

Mr. C. DRU DRURY (Sunderland) observed that only those who knew the works at Sunderland could realize the difficulties of storing and handling coke there.

Mr. C. F. BLINCOE (Middlesbrough) said that the paper dealt with problems which they all encountered sooner or later, and it had explained how to overcome those problems. He recounted the difficulties he had experienced with elevators when he commenced to run them after they had been out of commission for some time. They were of the single-chain type, and the result was that if one of the split pins snapped there was a general collapse. He would not put up another of the single-chain type.

Mr. SHADBOLT (Southbank) and Mr. F. C. WILLIS both testified to the efficiency of mechanical oilers.

Mr. ROBERTSHAW, in reply, said that the plant was about twenty years old, and he had to meet the troubles and make the best of them. Since he had altered the position of the lubricators on the main breaker, it had run for five years without any trouble. Renewals had to be made about every eighteen months before that. With regard to coke breaking when tipping, Mr. Robertshaw said that they had baffles placed to prevent this. When tipping coke into trucks, the wagon was lowered into the truck before it turned over.

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

Visit to the Works of the Derbyshire Silica Fire Brick Company, Ltd., Friden, near Buxton.

The Association visited the Friden Works of the Derbyshire Silica Fire Brick Company, Ltd., on April 25. The tour of the extensive works provided the members with much interesting information, and was thoroughly enjoyed by all who were present.

After tea, which was provided by the Directors, the following paper was presented:

SILICA AND FIRECLAY REFRACTORIES.

By A. T. GREEN, F.Inst.P., A.M.I.Chem.E., of the Derbyshire Silica Fire Brick Company, Ltd.

INTRODUCTION.

The study of the principles and practice of carbonization has shown very favourable progress during recent years. Investigations concerning the efficiencies of carbonizing installations have received adequate attention and have certainly led to well-placed improvements in the design and operation of such plants. Such work has naturally resulted in the focussing of conspicuous attention on the properties of refractories, for, with the trend of higher temperatures of carbonization, the duties of these materials of construction have been increased tremendously. Features concerning the durability of refractories which were hardly realized a decade or so ago are now being generally encountered. Many such are causing great trouble, and their elucidation is a matter of urgent moment to the gas industry. Perhaps the realization of the basic importance of refractories to the gas industry will result in the provision of the means for the solution of these problems.

SILICA, SILICEOUS, AND FIRECLAY REFRACTORIES.

In the carbonizing industries, the quality of both the refractory and the cement is of utmost importance. The size and shape of the refractory also have an important influence on the structural stability of the carbonizing unit. Naturally no definite rules concerning the size and shape can be laid down, since they must vary with particular circumstances. However, wherever possible the size and the shape which will allow of adequate handling are desirable. Such a size will also take an effective heat treatment during the firing operation in manufacture.

Present-day knowledge respecting refractory cements is not very extensive. Consequently these products vary considerably in constitution and effective properties. There can be no doubt that, in the absence of perfect technical definition, the best cement to use is that supplied by the refractory manufacturer for his particular product.

SILICA PRODUCTS.

Quartzitic rock—*i.e.*, ganister—forms the usual basic raw material used in the manufacture of "straight" silica bricks. The rock is crushed, ground, graded, mixed, and "tempered" with lime emulsion so that the final product contains about 2 p.ct. of lime. After being moulded into shape, the products are fired to high temperatures in the vicinity of Cone 16 (1460°).

The texture, and in some measure the final constitution, of a silica product are determined by the grading of the original raw material. In fact, there is an immense field for investigation in the problems connected with the influence of grading on the constitution and successful usage of the materials.

The constitution of silica products is determined, in the main, by (1) the nature of the original raw material (*i.e.*, ganisters and sands); (2) the manufacturing procedure, particularly respecting the grading of the raw materials, and the nature and amount of flux used, which is generally hydrated lime; (3) the control and extent of the firing operation. Silica has the property of existing in several crystalline modifications, the physical properties of which differ widely. Quartz, which is the stable modification at ordinary temperatures, may at high temperatures (over 1000° C.) be transformed into either or both of two other forms—*i.e.*, tridymite and cristobalite. These changes are accelerated by the presence of a flux such as lime, which is the common agent used in the manufacture of silica bricks. The acceleration appears to be due to the solvent action on silica particles of a viscous complex calcium silicate formed primarily by the interaction of lime and finely-divided silica. The solvent action is followed by the precipitation of the dissolved silica in the form of cristobalite. In any well-burned, lime-bonded silica bricks, tridymite, cristobalite, and quartz, together with 5 to 15 p.ct. of a glassy matrix of a complex calcium alumino-silica, may be present. The most drastic firing of "straight" silica bricks aims at the total elimination of quartz, and, as far as is compatible with the cost of continued firing, the production of an excess of tridymite. For coke ovens and gas retorts, those straight silica bricks which have received adequate firing are certainly the most successful.

The specific gravity of quartz is 2·65, of cristobalite 2·32, and of tridymite 2·28. Any straight silica brick, then, which has a true specific gravity of over 2·50 is poorly-fired and contains a large proportion of quartz. The medium-fired product has a specific gravity of 2·42, and, in consequence, contains an appreciable quantity of quartz, together with some cristobalite. In a high-grade product, which has a specific gravity varying from 2·32 to 2·37, the quartz content has been reduced to a practical minimum. These bricks, however, contain variable quantities of tridymite and cristobalite—a fact which plays a conspicuous part in the low-temperature spalling tendency.

SILICEOUS FIREBRICK.

The term may refer to a product made from a fireclay reinforced by quartzite particles of controlled size, or to one made from a pocket sand, found mainly in isolated pits in the carboniferous limestone of Derbyshire. This sand is comparatively pure, containing upwards of 93 p.ct. of silica, and is associated with a white siliceous clay containing upwards of 75 p.ct. of silica. By blending the sands and the clayey matter, a mixture containing 91 p.ct. of SiO_2 and an average of 10 p.ct. "theoretical" clay matter is obtained. On firing, this product "matures" in the neighbourhood of 1420° C., forming a comparatively rigid matrix, in which some silica has been dissolved and has afterwards been precipitated as cristobalite. Thus, such products contain in the main unaltered quartzitic particles, together with a small amount of finely divided cristobalite in a well-developed clayey matrix. This brick is probably the best type of quartzitic refractory.

FIRECLAY PRODUCTS.

The essence of clay is often conveniently referred to as "clay substance," which in its crystalline form is known as kaolinite; but when it exists as a colloidal, non-crystalline material, Mellor has termed it clayite. The commonly accepted formula for clay substance is $Al_2O_3.2SiO_2.2H_2O$. Besides this compound, fireclay contains variable quantities of accessory minerals, including quartz, micas, felspars, and iron and lime bearing minerals. As a matter of convenience it is desirable to consider the constitution of fireclays in terms of clay substance, quartz, felspathic and micaceous, ferruginous (ferrous and ferric), calcareous, and carbonaceous substances. Such a conception helps particularly in comprehending many phenomena associated with the firing and ultimate properties of fireclay products, including the vitrification, the colour and formation of "iron" blebs and patches, and the texture of the finished product.

In the manufacture of firebricks the raw materials are subjected to preliminary treatments, including mixing, grinding, screening, and tempering. Depending on the nature of the clay, varying quantities of graded grog (15 to 25 p.ct. of pre-fired fireclay), the very fine fraction of which has been eliminated, are added, and then worked into the clay in order to obtain a homogeneous mixture. This initial treatment is of great importance, since, if it is inadequate, the texture of the brick may be ruined. For instance, a laminated texture is particularly objectionable, since a product possessing it is liable to "spalling." The fireclay shapes, after being properly dried, are fired according to a predetermined schedule. During firing, many properties of the product are determined. Thus the oxidation period (500° to 850°) is mainly concerned with the elimination of carbonaceous matter, the oxidation of iron compounds, and the breakdown of carbonates, sulphides, and other

compounds, together with the decomposition of the clay molecule with the evolution of the water of constitution. At this stage, then, many properties are determined. "Ironcores" and "iron centres" have their origin in the inaccurate control of oxidation or the preliminary operation of water-smoking.

The final period of firing, ranging from 850° C. to the finishing temperature, is known as the vitrification range. Vitrification may be defined as the progressive partial fusion of some of the mineral constituents of the fireclay, including chiefly felspathic, calcareous, and ferruginous substances. It is governed among other factors by the composition of the body as a whole, the size of the grain, and the desired structure of the ware. In fact, the object of the heat-work during this period is the production of a suitable amount of vitrified or glassy material which will surround the remaining particles and fill the interstices to a suitable extent, dependent on the properties desired in the finished product.

During vitrification and the subsequent cooling period, a certain crystallization phenomenon takes place which appears to have a most important influence on the properties of fireclay products. Hyslop, among others, has stated that in the neighbourhood of 1000° a compound having the formula $Al_2O_3.2SiO_2$, known as mullite, is formed. It is, however, fairly definite that exceedingly minute crystals do appear in the neighbourhood of 1000° to 1050° C., and that their number and size increase with increasing heat-work in the vitrification range. Many factors—temperature, time, and the nature of the matrix present during vitrification—influence the formation of mullite. The effect of the matrix is particularly intriguing, for there appears to be a definite connection between the solubility of quartz in this viscous entity and the amount of crystallization of mullite. It is a well-established fact that siliceous fireclays contain free quartz varying in grain size from submicroscopic particles to grains of appreciable magnitude. After the moderate kiln firing to which fireclay products are subject, much of this quartz may remain as such embedded in the matrix or supporting structure of the fired product. Depending on the duration of the fire, the size of the grain, and the nature of the matrix, some of the quartz may be transformed into cristobalite. It does not necessarily follow, however, that high quartz content in a raw material will produce high quartz or cristobalite content in the fired product. Much depends on the grain size, the amount, distribution, and nature of the fluxing materials, and the firing procedure. Some quartzitic material may go into solution in the viscous flux during vitrification, and remain in this state after cooling. Dissolved quartz behaves rather as silica glass, and does not show the characteristic expansion of quartz and cristobalite. Other quartzitic particles may be transformed into cristobalite, while some maintain their identity.

Texture of Fireclay Products.

The texture of a fireclay product is controlled by (1) the grain size of the clay; (2) the nature and grading of the grog addition; and (3) the extent of the firing operation. Fineness of grain favours vitrification and so reduces the refractoriness or heat-resisting capability of the material. Consequently, it may be taken as axiomatic that the coarser the texture of a firebrick made from an individual fireclay, the higher its softening temperature.

As already mentioned, the refractoriness of a coarse-grained product is greater than that of a fine-grained one, other factors being equal. Further, the tendency of the coarse-grained brick to crack and split with abrupt changes of temperature is much less than that of a fine-grained product. The crushing strength and tenacity of a coarse-grained brick are, however, always low. Thus, gas retort sections with a feeble tensile strength are very friable and readily disintegrated by shocks, abrasion, and such actions. The pores of the coarser products are generally large, with the result that flue dust and slag penetrations rapidly take place in practice. Thus it appears clear that, with such antithetical properties for these two types of products, it is often desirable to compromise.

Some Important Properties—Refractoriness.

Refractoriness implies the resistance to softening under the effects of excessive heat treatments. It has been clearly recognized for some considerable time that the softening of clay and suchlike materials at elevated temperatures is not a specific property analogous to true melting, but involves both time and temperature factors. This recognition is of the utmost importance in emphasizing the arbitrary nature of the conception of refractoriness.

In the actual determinations of the refractoriness, as at present carried out, a definite size of cone (2 in. in height and ½ in. side for the triangular base) ground to the same shape as a Seger Cone, is used as the test piece. This is cemented into a slab (usually bauxitic) and surrounded by suitable Seger Cones. It is placed in a furnace, the temperature of which is raised by 10° C. per minute. The result is adjudicated either on the squatting of the test piece or its condition when a specific Seger Cone bends. Thus some investigators observe the Seger Cone which is bending as the material bends, and take this as an indication of "squatting temperature" or refractoriness. Others observe "signs of fusion" at a specific point in the heat treatment. Such signs adopted are: (1) Angular edges of the material beginning to lose their angularity, (2) piece showing signs of bending, and (3) matrix showing signs of running out. Though there are decided discrepancies between the two types of observations, either the one or the other gives some criterion of the value of a refractory material.

Squatting is in some cases—notably with certain Scottish clays—very rapid, while in others—notably certain Stourbridge clays—it is a comparatively protracted affair; thus illustrating the limitations in the effective indications of the refractoriness test. The refractoriness of a good fireclay or its product, under normal conditions of test, varies from Cone 20 to Cone 35 (1530° to 1770° C.), while that of a silica product varies from Cone 32 to Cone 34 (1710° to 1750° C.), and a siliceous product about Cone 30 to Cone 32 (1670° to 1710° C.). Such data form a preliminary guide to the heat-resisting properties of refractories.

Refractoriness Under Load.

The refractoriness test, though useful, gives no indication of the conjoint influence of pressure and temperature—a state of affairs more often encountered in industrial usage than the effect of fusibility *per se*. It is highly desirable to have data indicating the mechanical stability of a refractory at high temperatures. The study of refractoriness-under-load has proceeded for the past twenty years; and the early work of Mellor laid the basis of the present accepted test. Dale has developed this test to a high degree of proficiency, recently obtaining data of fundamental significance.

The original test consisted in heating a test piece 3½ in. by 2 in. cross-section under a definite load—usually 50 lbs. per sq. in.—at a rate of rise of temperature of 10° C. per minute in an electric furnace. The cone-temperature of collapse—*i.e.*, as indicated by definite amount of squatting or deformation of the test piece—was taken as an indication of the refractoriness-under-load. If The Institution of Gas Engineers' classification of silica and fireclay materials be accepted (silica products greater than 92 p.ct. SiO_2, fireclay less than 82 p.ct., and siliceous 82 to 92 p.ct. SiO_2), it is found that silica, siliceous, and fireclay products have approximate refractoriness values of 1720°, 1680°, and 1650° C. respectively, as indicated by the cone-temperature method. Under a load of 50 lbs. per sq. in., however, the temperatures of collapse of these three products are approximately 1670°, 1480° to 1600°, and 1350° C. respectively.

Variations from these figures depend on a number of factors, including (1) the composition of the refractory materials (*i.e.*, the amount of fluxes and iron oxide), (2) the firing treatment, and (3) the physical nature (*i.e.*, the texture). The rigidity of the silica brick is maintained up to the point of collapse, which is approximately 300° higher than the "safe" value for an average fireclay product.

By means of a lever system, Dale determines the movement of the test piece and carborundum supporting rods during the test. Since the carborundum shows a linear expansion, any deviation of the expansion graph from a straight-line curve is a characteristic of the brick under investigation. The data so obtained have given valuable information concerning the probable behaviour of silica and fireclay refractories in practice, and have elucidated a number of important practical points.

After-Contraction and After-Expansion.

Those changes which occur during the firing of refractory materials belong to a class known as "arrested reactions." In these the chemical and physical changes are arrested at particular and definite stages before they are completed. As previously indicated, when firebricks are burned or fired in the kiln, the fluxes melt and dissolve the less fusible materials, binding the whole more or less firmly together. A certain amount of contraction occurs during the operaion, and if not completed during the firing of the bricks, it will subsequently continue when the brick is in use. This is called the after-contraction. If this after-contraction is considerable, the masonry of the furnace will most certainly be displaced when the bricks are in use. The after-contraction must be small—certainly under 1 p.ct., when fired at 1400° C. for 2 hours.

Straight silica products usually show an after-expansion consequent on the more or less gradual change of quartzitic silica with a specific gravity of 2·65 to one or both of two other varieties with specific gravities of 2·28 and 2·32 respectively. The complete change involves considerable expansion, but it is a fairly slow reaction. It can be seen, therefore, that the original firing of silica bricks should result in such a reduction in specific gravity as is compatible with the subsequent use of the product. For coke oven and gas retort work, where an after-expansion would set up very bad strains in the structure, the after-expansion effect must be as low as possible; and thus the specific gravity of such material must be low, for Rees has shown that, with most lime-bonded silica bricks, except the very coarse-grained products, there is a linear relationship between specific gravity and after-expansion as obtained by test.

In the case of semi-silica or highly siliceous products, the tendency is to obtain a product which does not show either after-expansion or after-contraction. This may or may not be obtained where silica rock is added to a fireclay as a reinforcement; much depending on the grain size of the addition. In

the case of a pocket-sand silica product, however, such an approximation to a volume constancy, except, of course, for the normal thermal expansion, is obtained. Such a product containing approximately 10 p.ct. of clay substance and a very small quantity of micaceous and calcareous matters, together with about 80 to 85 p.ct. of free silica, is in large use in the gas industry of the day. When the matrix of this product is well developed, the structural properties, as far as the carbonizing industries are concerned, are of a high order.

INFLUENCE OF CARBONIZING CONDITIONS ON REFRACTORIES.

Owing to the lack of understanding of the reactions involved in the phenomena of corrosion, erosion, and disintegration, it is becoming increasingly difficult to specify products which will withstand certain industrial conditions without possible failure. "Iron," in its varied state in conjunction with carbon, the carbon gases, and certain other gaseous or volatile substances, is at the root of many observed cases of reduced life. The analysis of the reactions, however, is rendered exceptionally difficult by the existence of temperature variations and catalyzing influences.

In a general manner, the study of carbonizing conditions in relation to the durability of refractories can be resolved into a consideration of the influence of (1) temperature variations (*i.e.*, spalling), (2) constituental changes in the refractory or some of its constituents, (3) coal and coke in contact with the refractory wall, (4) deposited ash, (5) the burning gases in the combustion chamber, and (6) local circumstances, including features of the design and erection of the installation.

Spalling, which is the cause of much failure, may be described as the inability of a refractory to withstand without disruption those stresses induced by temperature fluctuations or thermal shock within a material. In this connection, then, the spalling tendency is defined by the coefficient of thermal expansion, the maximum shearing strain, and the coefficient of temperature diffusivity. Dependent on their constitution, silica refractories are prone to spalling at low and at high temperatures, owing to transformations in the nature of the silica. At low temperatures, it is exceptionally desirable that a silica installation shall be heated up very slowly, so that the volume changes do not cause disruption. At high temperature, changes in the nature of the silica may take place with resultant expansion; and these can and do give rise to cracking and disintegration. High localized temperatures, which may be obtained during the scurfing operation, can cause such an effect.

In the gas retort and the coke oven, "iron" can and does pass from the coking coal to the brickwork. There is evidence which suggests that the mechanism of this passage is associated with the formation of a complex gaseous compound which is decomposed on the surface or in the pores of the brickwork. Some suggest that in certain carbonizing operations iron carbonyl is formed. While this is not refuted, the present author is of the opinion that steam plays a considerable part in both the transfer and the subsequent influence of the iron. Much evidence of the existence of newly-deposited hæmatite is to be found in certain zones of a vertical retort, suggesting a series of reactions in the coke and then the brickwork, with the final crystallization of the mineral. How far this impregnation causes surface weakening is a point worthy of solution. It is pertinent here to note that Rees traced a case of "spalling" in a silica horizontal retort to the disintegrating influence of an impregnation. An investigation of certain "blackened" patches showed the existence of iron oxide, together with a deposition of carbon. Rees concluded that the presence of iron oxide facilitated the decomposition of carbon monoxide with the deposition of carbon and the consequent weakening of the structure.

During "scurfing," or the elimination of the incrustation encountered in the carbonizing industries, portions of the refractory are sometimes dislodged from the retort. Though a number of explanations may be put forward to account for this trouble, it may be that the depositions on and in the wall have had a weakening effect, probably at definite planes, which predisposes the material to failure during this operation. In any case, where the "scurf" is burned off by the admission of air, localized high temperature, owing to rapid combustion, may obtain; and this, besides embrittling, may easily disintegrate an already-weakened material.

Depending on the temperature and nature of the atmosphere, the "iron" exerts either a surface disintegrating action or a corrosive influence. Where the temperature is sufficiently high, fusible silicates will be formed, which, depending on temperature gradient, porosity, and nature of the matrix, among other factors, will tend to diffuse into the brickwork, probably causing ultimate failure. The nature of the atmosphere is of great importance—a fact well illustrated by the work of Vickers. This investigator has shown that the influence of steam in reducing the refractoriness of a cone containing added ferric oxide is very pronounced; the reduction being of the order of 200° C., from 1400° to 1200°. Further, such an atmosphere may reduce considerably the temperature of formation of fusible iron silicates, with the attendant increase in the fluidity of such a slagging agent at the temperature of action. The atmosphere in gas retorts and coke ovens is complex and variable; and such influences may be anticipated. Further, the gases often take selective paths by way of the wall in vertical retort work—a fact which must accentuate the action of the atmosphere at the surface. Where "steaming" is adopted, there certainly seem to be conditions such as will render the formation of fusible iron silicates comparatively easy. Erosion of retort work can take place by the rubbing action of coke on the more or less fluid surface—a circumstance which may lead to ultimate failure of the retort.

Coals used in the carbonizing industries contain sodium chloride in varying amounts from a mere trace to approximately 0·5 p.ct. When the coke has reached a temperature of 800° to 900°, the salt is volatilized, and, mixing with the gas in the retort or oven, is decomposed with the formation of soda and hydrochloric acid. The soda fumes penetrate the brickwork and give rise to a series of reactions which are detrimental to the brickwork. The final result of the reaction is the formation of the following corroding agents: Sodium chloride, sodium carbonate, ferrous chloride, and ammonium chloride. These penetrate the brickwork, and, reacting with its constituents, may bring about its failure.

At high working temperatures, an intermittent erosion, due to the detachment of a thin shaving of the face of the retort with the carbon at each scurfing period, may take place. It is probable that this thin, glassy, surface layer detaches itself from the brick owing to fluctuations in the temperature at the retort face during scurfing. Under moderate temperature conditions, the alkali fumes appear to penetrate to a greater depth beneath the surface before reaching a temperature sufficiently high to form a vitreous layer of silicate. Consequently, disintegration may take the form of flaking-off of an irregular layer, 0·5 to 0·75 in. thick, at intervals of 12 to 18 months.

In the case of fireclay material worked at low temperatures, alkali fumes cause the surface to become badly crazed after several years' working; but until disintegration takes place, the charging seldom causes any difficulties with the working of the retorts.

It is, of course, difficult to draw a line between the features of general significance and those which can be classed as particular, for many of the latter category contain aspects of fundamental importance. Perhaps the effects of (1) ash accretions or (2) the volume changes of the charge taking place during coking with certain types and mixtures of coal, or (3) local "hot spots" may be placed in this category, since alterations in the design and working of plants may prevent their detrimental influences.

The predispositions of the jointing cement to start failure has often been the subject of comment. In fact, the jointing cement has sometimes taken the blame for the failure of the refractory itself. This cement must be uniform in mixture, finely ground, and must possess a certain plasticity. This means that in all silica mortars a certain clay content is necessary. According to some observers, it is this clay content which serves to start failure by the attack of slag-forming substances. It would appear that if the cement has a monolithic structure under working conditions, the results, as far as the cement is concerned, will be very desirable. If, however, it contracts in its vitrification, leaving fissures and the like, the structure is predisposed to failure. To specify a cement to give ideal conditions is certainly difficult.

VOTE OF THANKS.

After tea, the PRESIDENT (Mr. F. B. Small) commented upon the various points noted during the inspection of the works.

Mr. C. E. TEASDALE (Salford), in proposing a vote of thanks, drew attention to the extensions which had been made since the Association's last visit some six years ago.

Mr. J. ALBINSON (Manchester) seconded the proposal.

Mr. FRANK WEST, in responding to the vote of thanks, cordially expressed his pleasure at meeting the members at the works. Co-operation between the firebrick manufacturer and the user, he observed, was essential to progress.

Manchester District Institution of Gas Engineers.—A meeting of the Institution will be held at Chester on May 18, when a visit will be paid to the Halton Works of Messrs. John Russell & Co., Ltd., the Directors of which firm will entertain the company at lunch at the Blossoms Hotel, Chester.

The "Rapid" per Ton Reckoner.—Messrs. Gall & Inglis, of 31, Henrietta Street, W.C. 2, and 12, Newington Road, Edinburgh, have published a reckoner bearing the above title, showing each penny rate from 3d. to 75s. per ton. For freight and tonnage rates, or for dividing up consignments among different departments or contractors, the book will be found extremely useful. The price is 1s. 6d. net.

North of England Gas Managers' Association (Auxiliary Section).—The seventeenth half-yearly meeting of the section has been arranged to take place in the Gas Office, Grainger Street, Newcastle-on-Tyne, at 2.30, on Saturday, June 2, under the Chairmanship of Mr. C. F. Barrow, Distribution Superintendent of the Sunderland Gas Company. Two papers are to be submitted—one by Mr. F. P. Fall (Sunderland) on "Ash Separation," and the other by Mr. L. G. Slack (Hartlepool), entitled "Purification."

RENEWING GAS SERVICE AFTER THE BREAK OF THE ST. FRANCIS DAM.

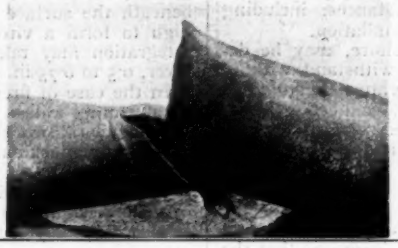
By ROY M. BAUER, of the Southern California Gas Company, Los Angeles, California.

[From the April issue of the American Gas Association Monthly.]

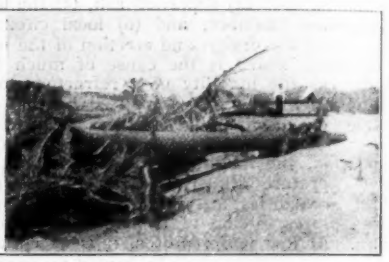
At twelve-fifty on the morning of March 13, with a dull roar, twelve thousand million gallons of water came rushing down San Francisquito Canyon on a destructive rampage through the Santa Clara River Valley to the ocean. This major catastrophe occurred after the breaking of the St. Francis Dam. Gas, electric, water, telephone, telegraph, raiload, and highway facilities were swept away by the tremendous force of onrushing waters.

The Southern California Gas Company suffered the loss of two 12¾-in. transmission lines from Taft (just north of Castaic Junction), and one 12¾-in. transmission line from Ventura (the latter was washed out in five or six places between Piru and Castaic Junction), and the Southern Counties Gas Company one 12¾-in. transmission line from Ventura along the Santa Clara River east of Piru.

Repairing break on Ventura line.



Welded line torn by flood. 12-in. steel line torn beside weld, and weld uninjured.



Steel-welded line bent by flood.

Luckily the Ventura Fuel Company's 15-in. line, which crosses Santa Clara River at Saticoy, was not damaged, and continued to deliver its fifty-four million c.ft. a day to Los Angeles.

At one-fifteen, the Castaic Junction meters (near Saugus) showed a marked drop in pressure in the main lines, and at one-twenty the Glendale terminal meters showed a marked drop in pressure in the main lines. Immediately, the Glendale terminal operator announced that a serious accident had occurred. Our main gas-works increased pressures on the Glendale-Los Angeles line, and at two-thirty gas was feeding into Glendale and Burbank. By four-thirty the valves on the main lines at Newhall and Castaic Junction and the main line meter stations in the Valley had been shut off. Gas was then started back to San Fernando. Thus, Glendale, Burbank, and San Fernando had a supply of gas at all times, though the pressure was low in some places for a short time after the break.

At daybreak a force of seventy-three men were making a house-to-house canvass in five towns, in the western portion of San Fernando Valley, which were out of gas. A connection was made to the Ventura Fuel Company gas supply, and, with the pressure available from the main gas-works, service was resumed about five-thirty in the evening.

The lines washed out were delivering sixty million c.ft. a day to the Los Angeles metropolitan area. To meet this deficiency, the electric steam generating plants at Los Angeles, Seal Beach, and Long Beach were switched to oil fuel at daybreak. Generators at the gas-works were heated, and runs of oil gas were made in the morning. About twenty-five million c.ft. a day of industrial business was curtailed before ten-thirty in the morning. Thus, we were able to make up the deficiency and maintain service without the manufacture of any appreciable amount of oil gas. Credit should be given to the Southern California Gas Company, the Southern Counties Gas Company, the Los Angeles Gas and Electric Corporation, and the Long Beach Municipal Gas Department for their splendid co-operation in the emergency.

At daybreak all available men and material were rushed to Castaic Junction. The situation was so serious that a small temporary line across the break was decided upon. It was placed in service at three-forty-five on the morning of the sixteenth.

The Southern Counties Gas Company likewise rushed men and materials at daybreak to Piru and vicinity, and commenced laying one thousand feet of 6-in. line for a temporary crossing over the river east of Piru, to connect its Newhall-Los Angeles line with the Southern California's Ventura line, which required replacing of only five hundred feet of line. This combination gave us the first gas at eight-fifteen on the morning of the fifteenth. The Southern Counties had their own line in full service at nine on the night of the seventeenth. The Southern California Ventura line was placed in service again at eleven on the night of the eighteenth. All repairs made were of a temporary nature, and were rushed through to ensure an adequate natural gas supply.

Gas Propaganda in Belgium.

To M. Eg. Van der Geten, Chief of Propaganda of the Antwerp Station of the Imperial Continental Gas Association, we are again indebted for a copy of the Official Yearbook of the Antwerp Chamber of Commerce; and it is good to find that gas has a prominent place in a publication which circulates widely in such an important centre of commerce and shipping. Also, it is gratifying to learn, from a series of photographs at the beginning of the yearbook, that Mr. A. F. P. Hayman, General Manager of the Antwerp Gas Undertaking, is held in such esteem by the Anversois as to have been Treasurer of the Chamber of Commerce since 1920. A section of the book is devoted to the gas industry, and full use is made of the opportunity of explaining how gas stands supreme in serving the community with a cheap and hygienic source of heat for room warming and cooking. The arguments, well known to gas men, are set out lucidly and in such a way as to appeal to the thinking public; and the gas fire section includes diagrams of the spectrum of a modern gas fire and of the "injector-ventilator" action of a Radiation grate. In the section devoted to cooking, the "New World" and the "Regulo" are hailed as a "revolution in the culinary art." The Gas Undertaking's announcements occupy three pages of advertising space. One sets out the latest scale of discounts; the other two appeal to industrialists, and offer them the free service of the Company's propaganda bureau.

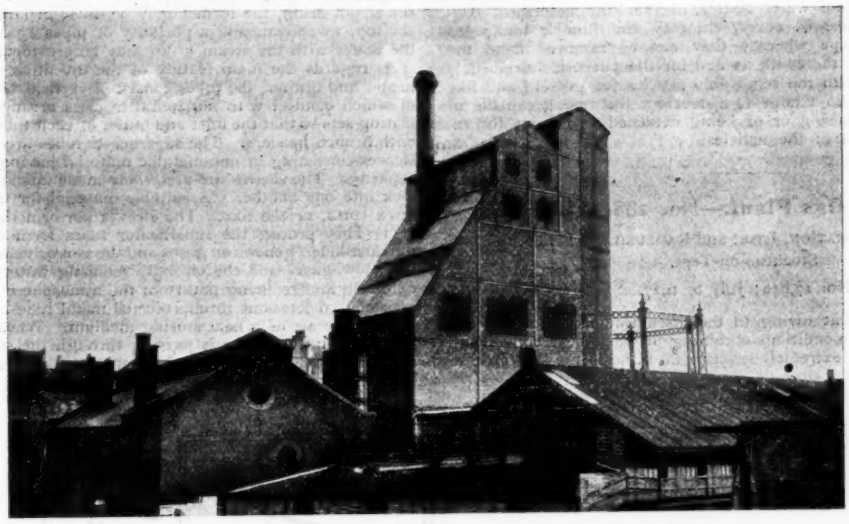
"Evening Star" Golfing Society.

A few days ago the "Evening Star" Golfing Society paid a return visit to the Moor Park Golf Club, Rickmansworth. In contrast to the weather conditions which prevailed at the autumn meeting—continuous rain throughout the day—the weather for the spring meeting, 1928, was all that could be desired. The course was in beautiful condition; and a good attendance of members had a thoroughly enjoyable day. The play in the morning was for the Silver Challenge Cup presented to the Society some years ago by W.Bro. Cyril Davis for annual competition. It was won by Bro. E. J. K. Fussell (15) with a score of 76—a very sound performance, as 76 is the bogey of the course. W.Bro. F. C. Tilley (18) was second with 81. In the afternoon, bogey singles were played. W.Bro. Cyril Davis took first prize with a score of 1 down, and Bro. E. J. Davison second place with 3 down.

Mr. Sensicle's North of England Association Paper.—There is a slight error which calls for correction in the paper, as appearing in the "JOURNAL" for May 9, which Mr. L. H. Sensicle read on "Recovery Methods and the Ammonia Problem" before the North of England Gas Managers' Association. The figure for the percentage of oxygen absorbed by "Other bodies," under the heading "Vertical Retorts Still Effluent," in the table on p. 389, should be 27·8, and not 2·8 as printed.

GLOVER-WEST VERTICALS AT SEAFORD.

[From the April Issue of "West's Gas."]



The Seaford Gas-Works were built about seventy years ago by a Mr. Thomas Crook, whose descendants are the present Directors of the Company. In 1926 the Company obtained an Order from the Board of Trade extending their area of supply to include the parishes of Seaford, Alfriston, Litlington, and West Dean, with portions of the parishes of Alciston, Berwick, Selmeston, and Bishopstone. The marked progress of the Company during the past few years is shown by the following figures:

Year.	Gas Made.	Gas Sold.
1920	38,041,000 c.ft. ..	31,613,000 c.ft.
1927	62,126,000 ,, ..	60,871,000 ,,

The works have been enlarged and modernized. The manufacturing plant is represented by a Glover-West vertical retort installation of a capacity of 400,000 c.ft. per diem, and a Humphreys & Glasgow carburetted water gas plant of 200,000 c.ft. daily capacity. The wet and dry purification plant has been extended to a daily capacity of 500,000 c.ft., and a spiral-guided gasholder of 500,000 c.ft. capacity is now in course of erection.

The vertical retort installation consists of eight Glover-West retorts arranged in units of two. Coal is brought to the plant in road vehicles and discharged into a coal-receiving hopper, from which it is mechanically fed into the mouth of a coal breaker. The retort bench is encircled by a West lip-bucket conveyor, which elevates broken coal to the bunkers above the retort bench and coke into the coke storage hopper. The whole of the machinery is actuated by steam, including the lift. Several interesting engineering problems arose in the adaptation of the plant to the existing site. These have been successfully solved, leaving sufficient space for an extension to double the present capacity.

The plant was designed for a daily capacity of 400,000 c.ft. of a calorific value of 500 B.Th.U., carbonizing Durham coals. The last report shows that a production of 404,690 c.ft. was obtained in 24 hours. The average calorific value was 504 B.Th.U. and the make per ton was 15,650 c.ft., or 78·9 therms.

REGISTER OF PATENTS.

Coin-Freed Mechanism —No. 288,367.

SIMPSON, S., of Exmouth.

No. 454; Jan. 7, 1927.

The object of this invention is to provide simple and effective means adapted to the construction covered in patent No. 261,831 [see "JOURNAL," Vol. 177, p. 37], whereby the mechanism may be used with coins of different values; the coin serving to cause the movement of a lever adapted to engage with the teeth of the measuring wheel.

According to the invention, the coin holder is formed as a diametrically mounted casing disposed on a rotatable disc mounted on the inner face of a stationary and adjustable disc, and within the coin holder there is provided a slidable member engaged with a spring-operated lever serving to engage the measuring wheel, which is of fixed position, on the introduction of a coin which displaces the sliding member. Means are provided whereby the point of engagement of the lever with the sliding member may be varied. Alternatively, the adjustment for different values of coins may be effected by varying the position of the fulcrum of the lever.

Ammonia Recovery.—No. 288,436.

SOUTH METROPOLITAN GAS CO., PARRISH, P., SNELLING, F. C., and WEIGHT, O. W., all of Old Kent Road, S.E 15.

No. 10,191; April 13, 1927.

According to this invention the whole or the greater part of the heat required for distilling ammonia from the liquor is derived from the waste gases from the retort settings. For this purpose the waste gases are passed first through a waste-heat boiler and then through a preheater through which the ammoniacal liquor is passed on its way to the ammonia still. Steam from the waste-heat boiler is used in the ammonia still.

For example, the waste gases from the retort settings may be drawn by a fan through two settings, one of which contains a tubular heater constructed to constitute a steam boiler, while the other contains a tubular heater through which the ammoniacal liquor is conducted on its way to the still. The waste gases pass first through the boiler setting; and the boiler is of such dimensions that the gases which have passed through it are at a temperature at least sufficient for heating the ammoniacal liquor to the required temperature. The hot liquor flows to the upper part of a column still, and the steam to the lower part thereof; lime being admitted as usual at a suitable point between the admission of liquor and steam.

A form of plant is described and shown diagrammatically.

Prepayment Mechanism.—No. 288,771.

TAUNTON, R. P., and MCINDOE, R. W., both of Birmingham.

No. 4319; Feb. 16, 1927.

The object of this invention is to provide an improved construction of clutch mechanism which is simple and inexpensive to produce and offers considerable advantages in use.

The patentees claim improvements comprising a sliding clutch member consisting of a plate with its plane parallel with the price changer and in sliding engagement with an intermediate disc at the rear of the price changer, and having an inwardly projecting tongue or horn for engagement by a coin, and a plunger or arm for engagement with notches or teeth in a gear forming part of the prepayment measuring mechanism.

Geysers.—No. 288,849.

CANNON, F., of Edgware.

No. 14,732; June 1, 1927.

This invention relates to geysers in which a number of trays are fitted inside a casing, one over the other, the top one of which is supplied with cold water from a pipe, the water flowing from each tray in succession through perforated ends or pipes of each tray, the trays being removable for cleaning or repair.

The object is a construction such that all the parts of the geyser, and not merely the trays, can be readily assembled and disassembled

and new parts positioned in place of worn-out parts without its being necessary to employ skilled workmen.

The invention can be carried out in a number of ways; and one example is fully described and illustrated in the specification.

The chief claims are:

1. In a geyser or like water heater of the kind described, constructing the trays, vessels, cover, chimney and funnel, tank, gas burners, and water pipe whereby they can be removed from the casing or re-positioned therewith as and for the purpose described.

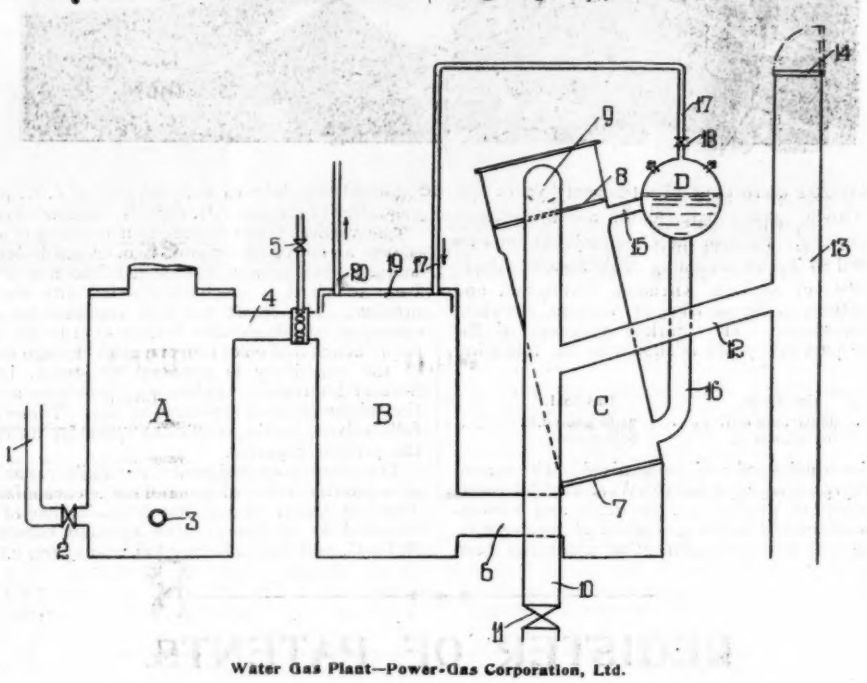
2. In combination with the removable articles for geysers and like water heaters claimed in Claim 1, a door for the casing capable of being secured to the casing or of being detached therefrom for removal and replacement of the articles.

Water Gas Plant.—No. 288,463.

Power-Gas Corporation, Ltd., and Rambush, N. E., both of Stockton-on-Tees.

No. 17,949; July 6, 1927.

The patentees say that owing to the discontinuous nature of the water gas process, the conditions obtaining in waste-heat boilers and steam superheaters are extremely severe, and hitherto the life of these parts of a plant has been comparatively short; and that the present invention provides an improved arrangement and design of water gas plant, including a waste-heat boiler and superheater, according to which a high efficiency of operation is secured together with long life. The invention comprises other features which will appear from the following.



Water Gas Plant—Power-Gas Corporation, Ltd.

In the diagram of the general lay-out, A represents a water gas generator, B a steam superheater, and C a waste-heat boiler. The generator A is provided with the usual equipment, of which for the present purpose it is sufficient to specify an air inlet 1 having a valve 2 and a steam inlet 3. Part or the whole of the steam introduced at 3 may be taken, if desired, from the superheater B. The generator is operated according to the usual cycle of blows and runs, and the hot gases are sent through the pipe 4 to the superheater B. When the generator is on "blow," the exit gas consists of nitrogen and carbon dioxide, together with a little carbon monoxide. As the blow continues and the temperature of the coke bed rises, the proportion of carbon monoxide in the exit gases increases. A certain amount of air, varying according to the quantity of carbon monoxide to be burnt, is admitted to the pipe 4 at the point 5; and the mixed air and blow gases pass into the superheater B, which according to this invention serves not only as a superheater but also as an igniter. The burnt gas gives up part of its heat, and leaves the superheater by the pipe 6 which communicates with the waste-heat boiler C, which is of the tubular type having a steam drum D and circulating pipes 15 and 16. The hot gases pass through the multiple tubes arranged between the tube plates 7 and 8, and emerge by the port 9 and pipe 10 to be sent into the branch 12 and the stack 13; the valve 11 on the pipe 10 being closed and the stack valve being open.

When the generator is on "run," the water gas passes into the superheater via the pipe 4 and gives up part of its sensible heat. It then passes into the waste-heat boiler C and leaves by the pipe 10; the valve 11 being open and the stack valve shut. If the water gas generator is a single unit, it will be seen that during the blow period no steam need pass through the superheater tubes in B since the generator is not using any steam. If, however, the generator forms a unit of a large installation, the superheater B can be used during the blow period of A for supplying steam to another generator which is on "run." In the plant shown in the diagram the steam may be passed into the superheater only as required by the generator, and therefore during the blow period the steam will collect in the boiler and steam drum D and the pressure rise correspondingly. When the valve 18 on the line 17 leading to the superheater is opened, rapid steaming will occur in the boiler, with corresponding pressure fall. To facilitate the quick and free escape of the steam from the boiler C to the steam drum, the former may be made of larger diameter towards the top, as shown, and a plurality of pipes 15 connecting the top of the boiler with the steam drum may be provided.

As regards the main feature of the invention, the combined superheater and igniter, the tubes consist of vertical U-tubes, the open ends of which connect with horizontal headers arranged in two interpenetrating sets so that the inlet and outlet of each tube connect respectively with branch headers. The superheater tubes are encased in protective sleeves consisting of non-metallic material having a high heat-storage capacity. The sleeves are preferably made in short lengths adapted to lock into one another. A suitable material for the sleeves is fireclay, terra cotta, or the like. The sleeves perform three functions:

(1) They protect the superheater tubes from the erosive action of the dust-laden generator gases and the corrosive action of the sulphurous blow gases and the strongly reducing water gas. The alternate oxidizing and reducing nature of the atmosphere in the superheater is extremely deleterious to unprotected metal tubes.

(2) They act as a heat storing medium. When the generator is on "blow" and no steam is passing through the superheater tubes, the hot gases give up part of their heat to the sleeves; and this stored-up heat can be drawn upon later when the run period is commencing and steam is being sent through the tubes.

(3) They act as an igniter for the mixed blow gases and air. The ignition temperature of the blow gases is higher the smaller their content of carbon monoxide; and as this condition exists at the earlier periods of the blow, it is important that the blow gases should come into contact with a hot surface (and not a steam-cooled one) so as to induce ignition.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for May 2.]

Nos. 11,826—12,554.

Blakeborough, R. A., and Brotherton, C.—"Non-return valves." No. 12,090.

Eagles, M.—"Gas lighting devices." No. 12,445.

Holzwarth, H.—"Combustion gas turbines." No. 11,863.

Koppers Company.—"Gas purification." No 12,411.

Morgan, G. T., and Pratt, D. D.—"Separation of constituents of low-temperature tar." No. 12,482.

West's Gas Improvement Company, Ltd., and Wild, W.—"Distillation of coal." No. 12,531.

Woodall-Duckham (1920), Ltd.—"Regenerative furnaces." No. 12,523.

Growth of the Malvern Gas-Works.—At a meeting of the Malvern Urban District Council, Mr. Morris, in presenting the report of the Gas Committee, said that very soon the Council would have before them the question of enlarging the gas-works.

Dukinfield Annual Report.—The report on the working of the Borough of Dukinfield Gas Department for the year ended March 31 shows that the sale of gas amounted to 101½ million c.ft., which was a decrease of 1½ millions on the previous year. The accounts, however, show a net profit of £1169 on the present occasion, which compares with a loss of £2067 a year ago.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Progress of Bills.

South Metropolitan Gas Bill: Read the third time, with the amendment, and returned to the Commons.

York Town and Blackwater Gas and Electricity Bill: Read the third time, and passed; sent to the Commons.

Dursley Gas Order: Referred to the Special Orders Committee.

Birmingham, Cockermouth, Hemel Hempstead District, and Otley Gas Orders: Agreed to.

HOUSE OF COMMONS.

Progress of Bills.

York Town and Blackwater Gas and Electricity and Weald Electricity Bills: Read the first time, and referred to the Examiners.

Windermere Gas and Water Bill: Reported, with amendments.

Birmingham and Cockermouth Gas Orders: Approved.

Research.

Mr. HARDIE, on May 8, asked the Secretary for Mines (1) the quantity or the equivalent of coal required to produce the hydrogen for hydrogenation, gas for heating, and power for compression, &c., in working the Bergius plant; and (2) what had been the experience of the Research Department with regard to the identity of all neutral oils from bituminous coal.

Commodore DOUGLAS KING stated that replies on such highly technical subjects would need so much qualification that it was not possible to keep them to a reasonable length. If Mr. Hardie would communicate more exact details of his requirements, he (Commodore King) would provide him with a statement.

After Mr. Hardie had taken Mr. Speaker's ruling on a point of order, Mr. HOPKINSON submitted that the information required could not be within the cognizance of the Secretary for Mines or any other Minister in the House. Such particulars as were available had already been published in the Press and in the proceedings of the various scientific societies. All those who were really interested in this matter, added Mr. Hopkinson, were perfectly well aware that the information already published was as much as could be expected in the present state of their knowledge.

Bye-Products.

Sir R. THOMAS asked the Secretary for Mines for a list of the collieries in South Wales and Monmouthshire which had installations for the treatment of coal for bye-products, and the figures for the output of the more important bye-products during the last five years.

Commodore DOUGLAS KING replied that the only information he had related to coke-ovens. He would send to Sir Thomas a list of the colliery companies to which these works were attached; but he was unable to state the amount of the bye-products recovered.

LEGAL INTELLIGENCE.

JOHN WRIGHT AND EAGLE RANGE COMPANY, LTD., v. GENERAL GAS APPLIANCES, LTD.

An Action for Infringement.

On May 7 the hearing of this case (see *ante* p. 402) was resumed.

Prof. *W. A. Bone* again entered the witness-box for cross-examination.

Mr. WHITEHEAD (for the defendants) put to the witness four prior patents relating to gas-fires—viz., Russell, No. 12,693, of 1904; Hattersley, No. 12,789, of 1906; Thompson, No. 15,094 (A), of 1906; and Hattersley, No. 7689, of 1909.

Witness said that, speaking generally, the Russell and the two Hattersley patents were canopy openings providing air passages sufficiently far above the fuel to ensure that air coming from the room would enter the chimney without passing through the fuel. He agreed that in prior fires there were dampers which might have had the effect of producing something like the two chimney streams of Yates' patent—one for the combustion products and the other for room ventilation. But the designs were not directed to the problems Yates had to solve, and did not obviously point the way. He agreed that in September, 1912, the sentence appearing in a technical article was as follows:

"The complete removal of the products of combustion from the fire connotes the removal at the same time of a large volume of air. If the radiants extend up to and into the canopy, this air will be mostly drawn over and from the radiants; the result being that the radiants are cooled down, and a serious decrease in the radiant efficiency of the fire ensues."

Witness added that it was about this period that the subject of ventilation was under investigation. Radiant efficiency and ventilation together constituted the new problem. Enlarging the distance between the canopy edge and the top of the fuel would enable air from the room to get into the chimney without cooling the radiant. The "Wizard" stove of the period answered the description. In his opinion the article was directed to preserving the ventilation and radiant efficiency by extending the gap between the top of the radiants and the bottom of the canopy. Yates' stove stated a problem which was not obviously solved. Witness was one of the first to see Yates' new invention, and he was astonished at what it did. Undoubtedly the method was simple; and it was obvious now, but it was not obvious then. Yates, by his invention of parallel streams, ensured that no products of combustion would get into the room. These were features which were very important, and showed the advantages over the earlier designs.

Tuesday, May 8.

Dr. *Harold Hartley* (Radiation, Ltd.), told the court that, for years, he had made investigations of gas fires. In 1912 he joined the Richmond Gas Stove Company as Chief Chemist, and in 1920 he was appointed Head of the Research Department of Radiation, Ltd. The question of gas fires and their uses had been investigated and reported on from time to time, and the point of radiant efficiency had been considered. He regarded a drop of 2 p.ct. as material, and he considered 40 or 45 p.ct. was a fair radiant efficiency. About 1913 he was concerned with the improvement of gas-fires that could be fitted in front of coal grates, and he found that the canopy played an important part in their efficiency. A standard that was accepted was that the canopy should be such as to take all the products of combustion. The outlet was to be extended, as in the case of the "Wizard" and "Apollo" stoves. He admitted that he was a little annoyed when he saw the plaintiffs' patent, as an important problem had been solved by a competitor. He came to the conclusion that extra ventilation must be provided for by increasing the flue opening; and in that he differed from Yates. He thought it best with gas-fires to have them close up to the grates. He had made tests with regard to thermal efficiency, and he found that as heat or fire 40 p.ct. passed up the chimney. The amount of air flowing up the chimney did not increase as the heat increased. Ventilation varied; and as far as he could judge, plaintiffs' patent had the results claimed for it. Speaking of the question of anticipation of the patent, witness did not think there was anything in the prior designs which would have been of assistance to the plaintiffs. He had carefully read Webber's article, and did not think it anticipatory. It was not a practical solution of the difficulty. The "Apollo" fire did not assist him in solving the ventilation problem. The "Apollo" stove was well known on the market about the time of plaintiffs' patent. The "Vandyke" was one of the latest put on the market, and he knew of the "Merlin" stove.

May 9.

Dr. *Hartley*, further cross-examined, when asked about tests said the Leeds test had always been relied upon to record the full measure of the radiant efficiency of a gas-fire. Judging by the drawings, the exit products flue in the chimney was certainly higher than the outlet of the air into the passage. The products exit was made higher because it was necessary that the fire should pass the "Lancet" test. Witness said that Prof. Bone investigated the "Wizard" and "Apollo" stoves in 1913, and the result of these investigations appeared in the Technical Press at the time. Witness asserted that the "Wizard" stove never attained the efficiency to pass the "Lancet" test. He thought the Yates' solution was a good one; the alternative was to put studs at the back of the gas-fire, so as to keep the stove away from the brickwork and to allow a free passage of air. He admitted that he had seen stoves with additional passages or spaces for air prior to the plaintiffs' patent. He would not go so far as to say that Webber's articles in 1908 did not make some contribution towards the knowledge of the problem.

Mr. *Kenyon*, a Director of John Wright & Co., Ltd., said the sales of the stove in question had risen from 17,000 in 1920 to 40,000 in 1926.

May 10.

On Thursday, the seventh day of the hearing, Mr. WHITEHEAD, K.C., opened the case for the defendants, submitting that the plaintiffs' patent was bad and did not contain either invention or subject-matter. As he read the claim, he said, it was not limited to the provision of a pair of outlet apertures arranged in such a way that they acted to give extra ventilation without diminishing radiant efficiency, while the plaintiffs' case depended upon the contention that it was directed to this. It said the claim would be infringed if one had an aperture which gave the ventilation, even with loss of radiant efficiency; and that being so, in his submission the maintenance of radiant efficiency was not the essence of the invention, though Sir Duncan Kerly had said it was.

His LORDSHIP: And if you establish that the maintenance of radiant efficiency is not essential according to the specification, you use that to show there is no invention and no subject-matter?

COUNSEL said he would show prior use of the means of obtaining ventilation, and that, without diminishing radiant efficiency, Yates' method enabled the ventilation to be carried out. But, obviously, from the diagram of that method, one would get a diminution of the radiant efficiency, because of the cooling of the radiants. He would argue on the footing that the claim was for a device, and not a method of user.

His LORDSHIP said he gathered that Mr. Yates was still alive. It would be interesting to hear what he intended when he contrived the passages and parts numbered and lettered in his diagrams.

Mr. WHITEHEAD alleged that the description of the patent and invention was insufficient, because it did not tell how to obtain the results promised, that it gave no dimensions, it offered the most meagre particulars relating to parts, and plaintiffs provided three diagrams that would not work.

May 11.

Mr. WHITEHEAD remarked that, assuming that the plaintiffs' patent was limited to two passages, both of which were in the canopy of the stove, it was necessary to distinguish between the part that could be properly called invention, and that which could properly be called design. The problem had been to find a stove that would give rise to

greater ventilation without diminution of radiant efficiency. That was the way the plaintiffs' case had put the problem.

Part of the conception of using two passages instead of one was not novel at the date of plaintiffs' patent, for it was plainly disclosed in Webber's publication. The idea that one passage should be higher than the other was conceived by Webber. Further, it might be said that the idea of two passages, one for the air and one for waste products from the stove, was also not new when plaintiffs' patent came into being, as it seemed plainly to be indicated by Webber. He urged that the Judge should differentiate between the invention and the stove on the market, and he submitted that it had been established out of the mouths of plaintiffs' witnesses that the "Apollo" stove—the stove having two passages—was undoubtedly in use commercially before the date of plaintiffs' patent. He also argued that plaintiffs had not given sufficient directions in their specification to enable their claimed invention to be carried out so that certain results might be obtained. There was not a word in the specification to indicate that it was an essential feature that one passage should be higher than the other—that the flue exit into the chimney should be above the air passage, or *vice versa*—and the specification, he submitted, showed a diagram where that condition was not made plain. Consequently, he argued that the patent was invalid because of insufficiency of detail. The question of ambiguity was a serious one.

With regard to infringement, the sale of defendants' stove was admitted. There was no question that their stove had two passages—one for combustion products and one for air. If the Court held that the words "without diminution of radiant efficiency" were words of limitation to be implied in the claim and governing the mode of operation of the apertures, then there was no evidence before the Court that the defendants had any case to answer.

Mr. *Horatio Ballantyne*, Consulting Chemist, then gave evidence for the defence. He said he understood that the object of the plaintiffs' stove was to secure ample ventilation of the room it was to heat. He could find nothing in plaintiffs' specification that was not disclosed by Webber in his sketch.

COMPENSATION CASE AT MANCHESTER.

Fatalities Caused by Short Circuit.

A claim for damages occasioned by deaths caused by asphyxiating fumes was tried before Mr. Justice Charles and a Special Jury at the Manchester Assizes on May 11. The plaintiffs were Mr. Thomas and Mrs. Louisa Standige, and the defendants were the Lord Mayor, Aldermen, and Citizens of Manchester. Mr. J. C. Jackson, K.C., and Mr. W. Gorman were Counsel for the plaintiffs, and Mr. T. Eastham, K.C., and Mr. F. B. Turner appeared on behalf on the Corporation.

The defendants admitted liability, and the only question for the Court to decide was the amount of damages.

Mr. Jackson, in opening the case, said it was one of the worst and one of the saddest cases that had ever come into the court, because it related to the death of three young girls and an old lady who were all sleeping in the same bedroom. The children were the daughters of the plaintiffs, and were named Edith Gibbon (17), Winifred Standige (12), and Hilda Standige (8½). There was no claim in respect of the death of the old lady. The eldest girl was the daughter of the female plaintiff by a previous marriage.

At the time of the accident, Mr. and Mrs. Standige, with their children and the old lady, resided at No. 2, Legh Place, Ardwick, Manchester, and on the evening of Oct. 24 last year the three girls and the old lady went to bed. In the early hours of the morning Mr. Standige was awakened by his wife, who was taken violently sick. He did not know what had caused the sickness, but he procured some soda water and milk for his wife, and the sickness ceased. About six o'clock in the morning he got up, intending to go to work, and went downstairs to prepare some breakfast. Soon afterwards a stepson, who lived in the house, went upstairs to knock at the bedroom door and awaken the girl aged 17, who also had to go to work. There being no response to his knocking, he went into the bedroom, and found the three girls and the old lady lying dead in bed.

The cause of the accident was ascertained to be that the Manchester Corporation had laid an electric main and a gas main in such a position that a short-circuit took place in the electric main. The heat generated appeared to have caused the gas pipe to fuse, with the result that poisonous gases penetrated through a cavity of the wall of the house, rose into the bedroom, and poisoned all four people.

In explaining the claim for damages, Mr. Jackson stated that the parents were not entitled to claim damages out of sympathy, but that they were entitled to claim them for any reasonable expectation of loss which they might sustain in the future in respect of pecuniary assistance from their deceased children. It was, therefore, necessary to consider very seriously what was the position of the family, which was one of working-class people. In the case of a well-to-do family, the younger children were not expected to be breadwinners and to help to keep their parents, but with a working-class family this was often necessary, as the amount of money coming into the house was frequently so limited that it had to be spent to the last penny every week in providing for the necessary expenses of the household. In the present case the father was an engineer's labourer, 55 years of age, while the mother was 50 years of age. At the time of her death the eldest girl was earning 15s. a week; and while the other two girls were still at school, in a few years they might reasonably be expected to contribute something towards the household expenses, and assist their parents in their advancing years.

All three girls were bright and clever; the eldest one, in addition to having gained two scholarships, having made herself efficient in shorthand, German, and French, for the purpose of improving her position with the firm by whom she was employed. The second was making herself proficient in playing the piano, in elocution, and in dancing, with a view to adopting those subjects for a career later. In the case of the youngest child, the parents had been prepared to make every sacrifice to fit her for the struggle of life, but, of course, nothing had been decided as to her future occupation.

Mr. Turner, for the Corporation, submitted that, as regards the second child, Winifred, and undoubtedly as regards the third child, Hilda, there was no evidence to go to the Jury, and quoted the case of *Barnet* v. *Cohen*, 1921, 2 K.B.D., p. 470, in support of his contention that the second and third children were so young that the possibility of their being of any pecuniary assistance to the parents was doubtful for some years to come.

Mr. Justice Charles: The law is, when reduced to common terms, that purely speculative possibilities do not form a basis for recovery of damages.

Mr. Turner said that was clear. With regard to the second girl of twelve, the evidence of her music teacher was that in four years' time she would be able to earn some small amount as a teacher of other young girls; but this would only mean that she would be less of a burden upon her parents than she had been for the previous years of her life. The question was, of course, one of benefit to the parents; not what the child would earn.

Mr. Justice Charles: If the child is able to earn enough to relieve her parents from the burden of supporting her, *pro tanto* there is a benefit, though possibly not a great one.

Mr. Turner: I cannot carry my submission any further.

Mr. Justice Charles, addressing himself to Mr. Gorman (for the plaintiffs), pointed out that in respect of the youngest child that it was looking a long way ahead to claim damages for the death of a child 8½ years of age. Such a claim accepted as a certainty that the child was going to live and, furthermore, would succeed in the calling or profession she adopted. It did not seem to lie outside the realm of speculative possibilities.

Mr. Gorman replied that in the case of *Taff Vale Railway* v. *Jenkins*, the principle had been laid down that there need not be any immediate contribution to the expenses of the household.

Mr. Justice Charles said the matter must go to the Jury, but he should give them a very clear direction in regard to the youngest child.

Mr. Eastham, in concluding the case for the Corporation, said that under Lord Campbell's Act, which was the statutory authority by which this type of action was brought, the right to claim damages was limited to actual pecuniary loss. Nothing could be allowed as a solatium for injured feelings, however much one might desire to make recompense in that respect. It had been decided by the courts that not even funeral expenses could be paid. In the case of two of the children, they were earning nothing, and it would probably be many years before they could earn anything. Mere speculative possibility of benefit was not sufficient on which to base a claim for damages.

Mr. Justice Charles, in summing up the case to the Jury, said they had been rightly told by Counsel representing both sides that feelings had nothing whatever to do with the matter. The claim they had to consider was the most cold-blooded form of claim possible. They had to set aside entirely all the pity they felt for the parents of such promising girls, and merely to consider what loss, if any, they had sustained in money by the death of their children. In the case of the young girl of 8½ years of age, for 5½ years she would have to be supported and clothed by her parents. When she attained the age of 16, there was really nothing to guide their judgment as to whether she would be of any value to the parents. Five-and-a-half years was a considerable time, and the child might not live; and also if she grew up to be sixteen, she might not be able to earn money, though she might be useful to her parents in the house, and that would entitle them to regard her as a pecuniary asset. He suggested that to award damages for the loss of a girl of that age was diving into the realm of speculation more than they ought. In the case of the second girl, Winifred, aged twelve, who showed such great promise with regard to music, &c., it was possible, according to her music teacher, that she might be able to earn something by the time she was sixteen. Therefore, the Jury, as business people, would have to use their good judgment in deciding what sort of contribution a girl of sixteen would be likely to make to her parents out of money earned by teaching music. The eldest girl was in a different position. She was an extraordinarily promising girl, seventeen years old, and earning 15s. a week, which was something tangible; and though she had to be kept out of that sum, yet it must be borne in mind that as she advanced in her business career her remuneration would increase, because the evidence was overwhelming that she was a girl of exceptional promise. In arriving at the amount of damages payable by the defendants to the plaintiffs, it was not necessary for the Jury to divide the sum into so much for the one child and so much for the other.

The Jury returned a verdict of £350 damages in respect of all three children, and judgment for that amount, with costs, was entered accordingly.

Mr. Eastham: I have been asked if your lordship will grant a stay.

Mr. Justice Charles: No, certainly not. I think the verdict is a very proper one, and it is not a penny too much.

Lighting at Abergele.—At a recent meeting of the Abergele Urban Council a long discussion took place with regard to the public lighting of the town. The members complained that the lighting was inadequate, and that the Council were paying for what they did not really get. The annual contract had come to an end, and the town, in consequence, was in darkness. Mr. Crabbe said that the lighting would soon cost them about £500 a year, whereas gas would cost much less. Mr. Edward Williams said they were paying the Electricity Company this year the sum of £390 for what they could have had from the Gas Company for £240; and the Gas Company would have given them a much better light. This, he said, meant 3d. on the rates, a fact which the public should know. It was resolved to refer the whole question to the Lighting Committee.

MISCELLANEOUS NEWS.

BLACKBURN FINANCE COMMITTEE AND THE TRADING DEPARTMENTS.

Drastic Standing Orders Adopted.

Resolutions giving effect to new standing orders for the financial control of Corporation Departments provided a long and animated discussion at a meeting of the Blackburn Town Council on May 3. There was a diversity of opinion among members of the various parties, but in the end the new standing orders were confirmed, with only seven votes against them.

Among other things, the standing orders provide that any work or article the cost of which exceeds £100 shall be the subject of a resolution which shall specify the work or purchase and the maximum amount authorized. Each committee shall provide a requisition book in which shall be entered by the heads of departments all articles required, or work to be done, or money to be paid, in or for their respective departments, not exceeding £100 on each order not being the subject of a resolution with their recommendations thereon. Such book shall be submitted to the committee, and each requisition therein, if approved, signed by the chairman.

The heads of departments may in case of emergency, and when delay may in their judgment be injurious to the service, order such articles to be supplied or such work to be done as may be necessary, duly reporting the same in such requisition book for approval and confirmation at the next meeting of the committee. All orders for articles required or work to be done shall be given on a printed form with all the necessary particulars, and signed by the heads of the respective departments, who shall see that original invoices are rendered by all persons supplying goods to or undertaking work for the Council.

Whenever any committee propose to spend a sum of money out of capital, such committee shall communicate their resolutions to the Finance Committee, and no proposition by any such committee involving expenditure out of capital shall be laid before the Council until it has been considered by the Finance Committee. It shall be the duty of every officer responsible for the supervision of expenditure to inform in writing the committee under which he serves, whenever an excess is to be anticipated on sums appropriated under any estimate by reason of extra works, or from any other cause, in order that a supplementary estimate may be put forward as early as possible.

Heads of departments when submitting to the committee reports recommending expenditure shall state whether or not such expenditure has been provided for in the annual estimates. The Finance Committee shall present to the Council at the March and September meetings a return of the Council's commitments upon capital account under all heads. Particulars of each contract entered into by the Council shall be supplied by the Town Clerk to the Borough Treasurer.

All orders given to a contractor for extras to, or deviation or alteration of, work comprised in a contract shall be in writing and signed by the head of the department concerned. . . . Copies of all orders shall be supplied to the Borough Treasurer immediately.

Alderman FIELDING, in moving the confirming resolution, explained that the new orders were in conformity with the recommendations of Mr. Dykes in the electricity report. Up to April, this year, there were no regulations or standing orders governing any of the Corporation Departments. So far the system had worked fairly successfully, but it was thought the present was an opportune time to make a change, and that they ought to have definite rules and regulations. His only desire was to apply to the Corporation the same principles which were applied to any large business. They did not want to let departments rule the head. What they did want was a head and regulations guiding every department of the Corporation, and they felt they must have them. There was nothing new or startling in these regulations. They were practically the same as those adopted by such Corporations as Wallasey, Chesterfield, Wigan, Manchester, Hull, and Southport. Inquiries at these towns showed there was not the slightest difficulty in working similar standing orders. It was not a question of what officials wanted or did not want, but rather one of the Town Council formulating its own policy. He wanted the officials of the Corporation to have every consideration.

Councillor ODDIE seconded.

Alderman HAMER moved the standing orders back for further consideration, and said something very drastic was being suggested. Alderman Fielding had referred to the officers of the Corporation. He would like to know whether these new orders were the recommendations of the Chairman, the Committee, or the Borough Treasurer? The chairmen of the various committees affected had not been consulted, and he did not think the officers had been. At any rate, the Gas Department had not been consulted. With these new regulations in force, the Gas Manager would not be able to carry on his Department as successfully as he had done hitherto. Under these new orders, they were giving to one official far too much power. The result was that there would probably be a great deal of overlapping between one department and another. They could not get away from the fact that there was not a solitary official in sympathy with these recommendations; and personally he regarded them as unworkable. It meant that the Gas Engineer would be unable to give an order for £105 without going before the Committee.

The TOWN CLERK: Under the orders, an official can always proceed in case of emergency.

Alderman HAMER said that under these regulations they were practically making one man the general manager for the Corporation. If they wished to make the Borough Treasurer the general manager of the Corporation, well and good; but they ought not to overlook the fact that they were over-riding officials of the Corporation.

Councillor EASTWOOD seconded the amendment, and thought the Council ought to visualize the effect these standing orders would have on the town's trading departments. They ought to separate the successful from the unsuccessful departments. What benefit would these standing orders be to the Gas Department, which had been built up by the energy, enterprise, initiative, and freedom of action of the head official? All this was taken away by such regulations. All that freedom would go, and before long the departments concerned would be down to the level of their unsuccesful departments. These orders, also, would not benefit the Electricity Department. They could not make a bad department into a good one by regulations of this sort.

Councillor FURNESS DEAN congratulated Alderman Fielding on "one of the finest measures of reform which has been introduced into this Council for over twenty years." He did not agree that the regulations gave the Borough Treasurer any special influence in the administration of any department. All he had to do was to check the figures of the departments.

Councillor BURKE gave support to the new standing orders, and said he did not share the view that it would mean that the Borough Treasurer would interfere with the management of any successful undertaking. It would be foolish on his part to do so. It would simply mean that the Treasurer would be a sort of auditor.

Alderman KENYON supported the opinions expressed by Alderman Hamer.

Councillor FRANKLAND supported the new standing orders, and said his only criticism was that they did not go far enough. In his view the Borough Treasurer ought to be made responsible for every penny paid out.

Councilor BATES said he regarded the case of the Electricity Department as the greatest argument in favour of more effective financial control than they had had in the past. On the other hand, they had capable men who managed their undertakings very successfully, and one did not want to feel that one was hampering these able men in their control of successful departments. He was not so much concerned about the chairman of a department as the person responsible for the management of the undertaking. It would be a good thing to have a conference, hear the objections of the officials, and see how far these could be met.

Alderman Sir WILLIAM FORREST observed that the standing orders had not been submitted to the various committees concerned. He had already suggested in committee that it would make for better relationships if they had been gone through by agreement, and had been discussed by the General Purposes Committee before coming before the Council. He supported them in committee as the basis for discussion, and not because he altogether agreed with them. Was it fair that the Gas and Education Committees should be made the scapegoats for some other department? Surely the Borough Treasurer was not going to be the guiding hand for either the Gas or the Education Department.

Alderman KAY suggested that the orders should go back for consideration by the chairmen of the different committees in the hope that they would come to some mutual agreement.

Alderman FIELDING, in reply, said that if the scheme was referred back, they would never get any agreement. He wanted heads of departments to be heads of departments, but he also wanted the head of the treasury to be the head of the treasury.

The orders were approved; there being, as stated, only seven votes for the amendment.

OPPOSITION TO LINCOLN GAS EXTENSIONS.

Lindsey's Three Grounds of Objection.

The Lindsey County Council are opposing the present form of the application of the Lincoln Corporation for powers to extend the limits of supply of their gas undertaking outside the city, including parishes in the Welton rural district. They propose that the Corporation's monopoly rights should cease at the end of five years.

The Clerk (Mr. E. Scorer) reported that objections had been lodged to the draft Order on the following grounds:

(1) That the price charged for gas supplied within the added limits to consumers by meter should not exceed the price charged for the time being to consumers within the existing limits of supply.

(2) That the clause in the draft Order for the protection of the County Council with respect to roads and bridges is inadequate.

(3) That the draft Order would apparently prevent any other gas undertaking from supplying gas within the added limits for an indefinite time, though there is no means of compelling the Corporation to supply gas in any particular district. Provision should therefore be made in the Order that the Corporation's monopoly rights shall cease after five years in order that other gas undertakings may apply for powers if the Corporation fail to furnish a supply.

The lodging of these objections was approved.

Issue of Stock at Northfleet.—The issue of £2735 additional ordinary "C" stock which Messrs. A. & W. Richards offered on behalf of the Directors of the Northfleet and Greenhithe Gas Company, Ltd., was over-subscribed at prices ranging from £102 per £100 down to the minimum of par.

Continuous Coal Carbonization.—Presiding at an extraordinary general meeting of Continuous Coal Carbonization, Mr. George Marsden (Chairman) stated they had acquired on the Thames at Erith a site admirable from a manufacturing and a distributing point of view, and were about to instal their first unit carbonizing some 50 to 60 tons of coal a day. They intended as soon as possible to increase the number of units to a capacity of 1000 tons a day. They had no intention of injuring the coal industry.

NOTTINGHAM GAS UNDERTAKING.

Another Successful Year—Gross Profit £137,148.

It has been for a long period in the nature of an annually recurring and welcome event that the Nottingham Corporation gas undertaking has maintained a consistently high level of remunerative results. The report of the Committee, of which Alderman Sir Albert Ball continues to act as Chairman, has just been issued, with the accounts up to March last; and it shows that last year the gross profit amounted to £137,148, representing (with the exception of the years 1923 and 1924, when respectively £181,367 and £165,502 was realized), the largest total within the last decade. The Committee propose to allocate this year (under the terms of a resolution passed some time ago by the Council relative to the ratio in which the profits of the City's trading concerns shall be laid under contribution) £30,000 in relief of the rates.

The Committee state in their report that the income for the year on revenue account amounted to £677,962, and the expenditure to £540,815, leaving a balance of £137,147 to be carried to the profit and loss account. To this balance is added £3258, representing bank interest and interest on revenue account investment, together with £26,327 brought forward from last year. After charging interest on capital, contributions to sinking funds, and £20,000 for depreciation of mains, meters, and stoves, there remains an available balance of £67,247. The Committee, having decided to allocate £30,000 as a contribution in aid of the general district rate, recommend that the balance of £37,247 be carried forward. The balance of revenue account is £50,708 more than last year. On the income side of the accounts the amount realized from the sale of gas was practically the same as in the previous year, there being an increase of £701 only, though the actual increase in the sales of gas had been 22,289,400 c.ft. (105,875 therms). This result had been due to larger quantities of gas having been consumed at the lower prices during the year. There are more than 100,000 meters now in actual use.

The income from residual products was seriously affected by a decrease of £37,084 in the receipts for coke; prices being materially lower throughout the year. The Committee are of opinion that the financial result for the year is satisfactory. The Council would be aware that the Committee have received several offers during recent years of supplies of coke oven gas for town use; and though these negotiations have not materialized, it is still possible that supplies may be obtained on favourable terms in the near future. The Committee have given careful consideration to the question of a reduction in the charges for gas, and ask the Council to bring into operation, as from the Midsummer reading of the meters, a scale of charges which represents approximate reductions of 2d. per 1000 c.ft. in the case of ordinary consumers and 3d. per 1000 c.ft. in the case of prepayment consumers.

Mr. John Wilkinson's Report.

Mr. John Wilkinson, Engineer and Manager, in his seventeenth annual report, explains that during the period under review 217,510 tons of coal and 141,860 gallons of oil were utilized in the course of manufacturing the following: Coal gas, 2,990,162,000 c.ft., or 14,201,846 therms; water gas, 59,626,000 c.ft., or 282,326 therms—total, 3,049,788,000 c.ft., or 14,484,172 therms. Coke (for sale), 104,215 tons; tar, 13,665 tons, and ammoniacal liquor (10 oz. strength), 35,947 tons.

The following are the details of the sales of gas:

	C.Ft.	Therms.
Ordinary consumers . . .	1,377,213,900 =	6,541,766
Prepayment ,, . . .	1,050,306,400 =	4,988,955
Power ,, . . .	211,615,300 =	1,005,173
Industrial ,, . . .	119,582,000 =	568,017
Public lamps	158,861,200 =	754,591
Totals	2,917,579,400 =	13,858,502

These figures indicate an increase of 22,289,400 c.ft. (105,875 therms), or 0·77 p.ct., when compared with the sale of gas for the previous year. The gas unaccounted-for was 132,208,600 c.ft., or 4·33 p.ct., as compared with 4·97 p.ct. for the previous year. The sale of gas per ton of coal carbonized was 13,151 c.ft. (62·5 therms), as compared with 13,627 c.ft. (64·7 therms) for the previous year. These figures are not, however, strictly comparable, in consequence of the emergency conditions which prevailed from May to December, 1926.

The total length of mains laid at March 31 was 468·92 miles; while 3854 new gas services were connected to the mains, against 3188 in the previous year. The number of meters fixed at March 31 (excluding 442 lamp meters) was 101,345, being an increase of 3063. The average consumption per meter (exclusive of lamp meters) equalled 26,926 c.ft. (127·9 therms), as compared with 27,942 c.ft. (132·7 therms) in the previous year. The position of gas in its application for trade and domestic purposes has been maintained; and, according to official records, there were in use at March 31 58,972 gas cooking stoves and 28,800 gas fires. These figures do not include a number of cooking stoves, fires, and other appliances of various descriptions which have been purchased privately by the consumers, and not recorded in the books of the Department.

CROYDON GAS COMPANY'S CO-PARTNERSHIP.

Mr. William Cash Addresses a Large and Enthusiastic Gathering.

Not one of those who formed part of a crowded audience in the North End Hall at Croydon on Monday evening, May 7, can have doubted that a spirit of real enthusiasm and goodwill is engendered by a well-devised scheme of industrial co-partnership. The occasion was a social evening for co-partners and their wives (or sweethearts) in the Croydon Gas Company; and perfect arrangements, a lucid explanation of essential facts by Mr. William Cash, F.C.A. (the Chairman of the Company, and of the Co-Partnership Committee), and a first-rate programme of entertainment combined to make up an extremely enjoyable evening. Music was followed by the business meeting; and then, after an interval for light refreshments, Fred. Wildon's Entertainers occupied the stage. Mr. Cash was supported on the platform by the Deputy-Chairman (Mr. Thomas Rigby), Mr. Charles Hussey, J.P., Mr. Harold Williams, O.B.E., F.S.I., and Mr. Guy Savory (Directors), Mr W. J. Sandeman (General Manager), Mr. Walter Grogono (Engineer), and Mr. Frank F. Wood, A.C.I.S. (Secretary).

Bonus Raised to 6¾ P.Ct.

It was the sixth annual co-partnership meeting; and the Committee's report and the statement of accounts which were submitted by Mr. Cash were for the year ended March 31 last. Mr. Cash, after expressing his pleasure at facing so large a gathering, went on to say that perhaps the most satisfactory feature of the report of the Co-Partnership and Works Joint Committee was the fact that the bonus this year was at the rate of 6¾ p.ct., which compared with 6½ p.ct. for the previous year. This was a move in the right direction. The bonus was at the same rate per cent. as the Company paid in dividends on its sliding-scale stock. The two dividends for the past year on this stock were at the rates per annum of 6½ and 7 p.ct. respectively—making an average of 6¾ p.ct. for the twelve months. The number of co-partners was a record. From 726 in 1920, the number had grown, until there were this year 930 co-partners, which was 35 more than twelve months ago. The bonus, too, was the highest yet paid; and for these two reasons the total amount distributed was the largest that had been recorded. From the inception of the scheme in 1909, 1721 co-partnership agreements had been entered into. The total amount paid by way of bonus was £90,751. A sum of £25,978 had been invested by co-partners in the Company's stocks; and the amount held by Trustees for co-partners at March 31 last was £26,569. The nominal amount of the Company's stocks standing in the names of co-partners and annuitants at that date was £27,732.

Official Changes.

Proceeding, Mr. Cash pointed out that during the year a number of co-partners had retired on pension. Included among them, he said, was Mr. A. Caddick, their late Engineer, whom they were glad to see among them that evening. Since the meeting a year ago (when the impending change was announced by him), Mr. Caddick's place had been filled by the appointment of Mr. Walter Grogono. Those who worked at Waddon would already have made Mr. Grogono's acquaintance; and all who had read what was said at the last annual meeting of the Company would remember that he came to Croydon after many years' experience with the Gas Light and Coke Company, where he had been in close touch with the very best and most modern gas-works practice and engineering. The Directors were pleased that they had been able to secure Mr. Grogono's services, and believed he would prove a great source of strength to the undertaking in the future. They wished, therefore, that he might spend many happy years with the Company. [Applause.] When speaking to them a year ago, he told them that Mr. William J. Russell, one of the Directors, was not able to be present; and very shortly afterwards Mr. Russell informed them, to their very great regret, that his state of health would not allow him to continue any longer on the Board. Mr. Russell had served the Company in one capacity or another, as man and boy, for 65 years. This, he thought, must be almost a record. The vacancy caused on the Board by his retirement had been filled by the appointment of Mr. Guy Savory, a gentleman well-known in Croydon. As the result of a re-arrangement of offices, the Directors had made Mr. Sandeman their General Manager. [Applause.] Still touching upon personal matters, he expressed the indebtedness of all connected with the Company to the Editor and those who were associated with him in making the Company's Magazine the success which it undoubtedly was. It appeared to him to be as good as any of the Co-Partnership Magazines which he saw; and there was a great deal in it which was both informative and interesting.

The Company's Progress.

Referring to the business of the Company, Mr. Cash said that the year 1927 was very different from 1926, when they were so greatly hit by the coal stoppage. They were, in fact, still carbonizing foreign coal at the beginning of 1927. In April of that year the price of gas was 11d. per therm; but on July 1 they came down to 10·4d., and on Oct. 1 to 9·8d., which was the pre-coal strike price. This process of reduction was resumed on Jan. 1, 1928, when the price was fixed at 9·6d. per therm, which figure was further lowered on April 1 to 9·4d. The consumers must be pleased that the Company had been able to reduce the price of gas in the way they had done. In 1926 they sold an extra 82 million c.ft. of gas, as compared with the immediately preceding year; and in 1927 there was sent out a further 100 million c.ft. Thus the business continued to grow in a gratifying manner. The Company gained 3442 new

consumers last year—2129 ordinary and 1313 prepayment. They were all aware of the extension of building that was going on all over their area. This indicated that the business of the Company had still plenty of room for expansion. At the end of 1927 the total number of consumers on their books was 67,061. A new carburetted water gas plant was being installed at the works; and Mr. Grogono, in view of the extraordinary growth in demand, had informed them of the necessity of providing further coal gas plant. The contract for this had been given; and they were going to put up some new vertical retorts, in place of one of their existing retort houses. This would furnish increased coal carbonizing capacity. He reminded his audience that in 1926, in order to pay the dividend that was then declared, they had to take from the reserve fund £2618, and from the insurance fund £5381; while in addition to this they used up the whole of the available carry forward brought in from 1925, amounting to £10,088. In other words, they did not earn the dividend by some £18,000. In 1927, however, they were able to restore the position. The picture was indeed a different one. They were able to add £6889 to reserve and £10,000 to the renewal fund, and at the same time carried forward £14,681. These sums totalled £31,570. In addition to this, they were able to pay £10,000 to the pension fund.

In conclusion, Mr. Cash re-affirmed his belief in the principle of co-partnership in industry, and expressed the cordial thanks of the Directors to all those present for everything they had done on behalf of the Company during the past year.

The co-partnership report and accounts were unanimously approved; and at the call of Mr. G. E. Walkley (one of the Co-Partners' Representatives on the Committee), three hearty cheers were given for the Chairman.

LONG-SERVICE AWARDS.

A year ago thirteen long-service awards were made by the Chairman to men who had completed 25 years in the Company's employ; and, by a curious coincidence, on the present occasion there were also thirteen co-partners who were similarly honoured. The award in each case is an illuminated certificate, accompanied by a gift to the value of £5.

GAS METER TESTING IN BIRMINGHAM.

The Gas Meter Testing Committee of the Birmingham Justices, in their annual report to be presented at a meeting on May 18, state that the results of the Department have been, on the whole, satisfactory, though the number of meters tested during the year totalled 106,209, as against 116,136 in the previous year. This decrease coincided with the general reduction in the demand for gas meters as reported in the latest Board of Trade returns. The fees received were lower by £489 9s. 6d. The general efficiency of the Department continued to be satisfactory, and the reasonable requirements of the manufacturers of meters and of the local authorities of the surrounding districts were being fully met. The income during the year amounted to £6331, and there was again a contribution to the rates of the city amounting to £2891. The report of the inspector states that, of the wet meters tested, 7882 were stamped and 312 rejected (3·8 p.ct.); and of the dry meters tested, 94,733 were stamped, and 3282 rejected (3·3 p.ct.).

TRADE NOTES.

Tables of Weights of Tubes.

Messrs. Stewarts & Lloyds, Ltd., of Glasgow, have published a table of weights of tubes. The introduction gives the general formula for the weight of any tube, and develops it, for steel tubes, to suit different units. Conversion factors between metric and British units, and between steel and wrought-iron tubes, are also given. The tables proper include the weights of wrought-iron and steel tubes in all usual commercial sizes and thicknesses, and "weight factors" for facilitating the calculation of the weight of any steel tube of thicknesses varying from 0·001 in. to 1 in. inclusive. Two charts are included by which the weight, and price, per foot of steel tubes can be found directly over a considerable range. Copies of these tables may be had by all users of wrought-iron and steel tubes on application to the Publication Department, Messrs. Stewarts & Lloyds, Ltd., 41, Oswald Street, Glasgow.

CONTRACTS OPEN.

Coal.

The Gainsborough Gas Committee invite tenders for the supply of gas coal. [See advert. on p. 479.]

Tenders are invited by the Barnoldswick Gas Department for the supply of gas coal. [See advert. on p. 478.]

The Ellesmere Port and Whitby Urban District Council are inviting tenders for the supply of washed gas nuts. [See advert. on p. 479.]

Pipes.

The Hinckley Gas Department invite tenders for supplying and laying weldless steel pipes. [See advert. on p. 478.]

Tar.

Tenders are invited by the Ellesmere Port and Whitby Urban District Council for the purchase of their surplus tar. [See advert. on p. 479.]

Reduction in Price at Penzance.—The Penzance Gas Company announce a further reduction in the price of gas of 3d. per 1000 c.ft., as from the June quarter.

COAL TRADE REPORTS.

From Our Own Correspondents.

NORTH-EAST COAST.

There has been little change in the market position during the past week. There was some irregularity in tonnage arrivals at one time, which left certain collieries temporarily short of an outlet. But generally such positions are being met by lying idle and reducing output, rather than throwing coal on the market at any price. There is still no agreed selling scheme in Durham, but the idea of maintaining prices in this way is apparently being largely followed.

The outlook for the future is being generally regarded more hopefully than for some time past. There is plenty of inquiry from abroad, and, though Poland is still in a favoured position, the increase in costs in Germany is likely to be helpful to us. Recent covering by speculators who had sold short indicates an impression that prices are unlikely to go lower, and merchants are inclined to buy coal at present prices to hold.

Current quotations show little alteration. Wear Special gas makes ask 15s. 6d. to 16s. f.o.b., and best qualities 15s. Seconds and others are 13s. 3d. to 13s. 9d. Coking has been weak, and best brands are easily obtainable at 13s. 6d. f.o.b. Best Durham bunkers continue firm at 14s. 6d., with seconds offering at 13s. 6d. Northumberland steams maintain the minimum agreed prices of 13s. 6d. for best screened sorts downwards. Current demand for gas coke is slow, but inquiry is brisk for forward positions. For prompt, 19s. 6d. f.o.b. is asked, but makers are not offering forward at this figure.

YORKSHIRE AND LANCASHIRE.

Gas coals are fairly well placed ahead, and recent sales show very little alteration as compared with last year's figures.

Industrial fuel generally is rather spasmodic. The market, however, is fairly steady, and there is no shortage.

Coking smalls are rather discounted, and furnace coke is slightly easier than was the case last week.

The export section has now received permission to allocate more fuel, and business in this direction is rather more animated than was the case some weeks ago.

Prices on the Humber include the following: Best South Yorkshire hards, 15s.; best South Yorkshire washed doubles, 14s. 6d.; ditto washed singles, 13s. 6d.; West Yorkshire Hartleys, 14s. 9d.; West Yorkshire trebles, 15s. 3d.; washed coking smalls, 12s. 6d.; dry nuts, 12s.

MIDLANDS.

Interest centres in the attempt to raise prices initiated by the Central Collieries Commercial Association. The demand for a general advance of 1s. 6d. a ton does not appear to be uniformly pressed throughout the area to which the Five Counties Scheme extends. After ten days' experience, the Cannock Chase Associated Collieries reaffirmed the decision to enforce the advances notified at the beginning of the month. This is stated to be an isolated action. In any case, the advance is being paid on only a very small proportion of the coal now going into consumption.

The Warwickshire coalfield, contiguous to Cannock Chase, is linked up with the Five Counties Scheme to the extent of only about half its collieries, and there the revised lists were, according to report, stillborn. Supplies have been ample for current needs. Whatever deficiency there is in the output under quota restrictions is made up by the independent collieries. They are working six days a week in some cases. Consumers believe there are further resources to draw upon in their opposition to the associated collieries, should the need arise.

It looks as if collieries which refuse to withdraw the increased quotations will need all the assistance they can get under old contracts if they are to dispose of the 67½ p.ct. quota this month. The leverage that can be obtained from the house coal trade is almost negligible in the waning market of this season of the year. Large numbers of Cannock Chase miners are registering at the employment exchanges.

Gosport Debenture Stock Issue.—Messrs. A. & W. Richards have been instructed by the Directors to offer for sale by tender £25,000 of 6 p.ct. redeemable debenture stock (to be redeemed at par on Jan. 1, 1940) of the Gosport District Gas Company. The minimum price at which stock will be issued is par; and tenders must be forwarded to the firm at 37, Walbrook, London, E.C., by Tuesday morning, May 22. The continued rapid progress of the Company's business has rendered necessary the provision of further storage capacity and other additions to the manufacturing plant; and it is to meet this expenditure that the present issue is being made.

Bordon and District Gas Company.—The Directors' report for the year ended Dec. 31, 1927, states that the receipts amounted to £10,600 and the expenditure to £7789, leaving a surplus of £2811 to be carried to profit and loss account. After allowing for interest amounting to £402 on loan capital, and £1391 for dividends on account of arrears to Dec. 31, 1926, declared in July last, there is a balance on profit and loss account in favour of the Company of £4162. The Directors recommend a dividend at the rate of 5 p.ct. per annum, less tax, on account of arrears to Dec. 31, 1927, payable on July 23, which will absorb £1391, leaving £2771 to be carried forward. The Electricity Commissioners have so far withheld their sanction to the Company's application for electrical powers; which has involved the Company in heavy expenditure. The increased sales of gas over 1926 amounted to 1,361,300 c.ft., or 6807·5 therms. The charges for gas were reduced by 1s. 3d. per 1000 c.ft. in June last, and a further reduction of 2d. per 1000 c.ft. was made in December last.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *May* 14.

The market for pitch continues quiet, and little business is reported. The price is unchanged at not below 65s. per ton, f.o.b. makers' works.

Creosote also is quiet at 8⅝d. to 8½d. per gallon.

Pure benzole is 1s. 8d. to 1s. 9d. per gallon, pure toluole about 2s. 2d. to 2s. 3d. per gallon, and 95/160 solvent naphtha about 1s. 7d. per gallon.

Pyridine is 5s. 3d. to 5s. 6d. per gallon.

Tar Products in the Provinces.

May 14.

Markets for tar products generally have been quiet during the week.

There is still little inquiry for pitch from the Continent, and consumers in South Wales appear to be fully covered for the moment. There is no anxiety on the part of producers to sell.

Creosote oil is quiet, with an absence of demand for both home consumption and export, and prices are decidedly easier.

Water-white products continue firm, and there is a fair amount of inquiry.

Crude carbolic is still in good demand.

The best qualities of cresylic are inquired for; but the inferior grades are difficult to sell.

The inquiry for naphthalene continues; but buyers are resisting the advanced prices.

The average prices of gas-works products during the week were: Gas-works tar, 44s. to 49s. Pitch—East Coast, 62s. 6d. to 65s. f.o.b. West Coast—Manchester, 55s. to 57s. 6d.; Liverpool, 57s. 6d. to 60s.; Clyde, 60s. to 62s. 6d. Toluole, naked, North, 1s. 5d. to 1s. 6d. nominal. Coal-tar crude naphtha, in bulk, North, 8d. to 8½d. Solvent naphtha, naked, North, 1s. 1½d. to 1s. 2d. Heavy naphtha, North, 1s. to 1s. 0½d. Creosote, in bulk, North, liquid, 6½d. to 6⅝d.; salty, 6⅝d. to 6⅞d.; Scotland, 6⅞d. to 6⅞d. Heavy oils, in bulk, North, 8½d. to 8¾d. Carbolic acid, 60 p.c.t., 2s. 3d. to 2s. 4d. prompt. Naphthalene, £13 to £15; salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.c.t., purely nominal; "B" quality, unsaleable.

The following are considered to be the market prices to-day:

	s. d.	s. d.	
Crude benzole	0 10½	to 0 11	per gallon at works
Motor ,,	1 4½	,, 1 5	,, ,, ,,
90 p.c.t. ,,	1 5½	,, 1 6	,, ,, ,,
Pure ,,	1 9	,, 1 10	,, ,, ,,

Association of Statutory Inspectors of Gas Meters.—The Association will hold their annual conference in Birmingham on July 4 and 5.

Reduction in Price at Stourbridge.—The Stourbridge Gas Department have given notice of a reduction of 6d. per 1000 c.ft. in the price of gas for power purposes.

Reduction in Price of Gas at Iron-Bridge.—The Iron-Bridge Gas Light Company, Ltd., have reduced the price of gas from 5s. 6d. to 4s. 10d. per 1000 c.ft. for ordinary purposes, and to 3s. 10d. for power. A scale of discounts is in operation.

Gas Exhibition at Sittingbourne.—At present there is being held in the Sittingbourne Town Hall a gas exhibition organized by the Sittingbourne District Gas Company. Miss A. M. Strick is giving cookery lectures and demonstrations twice daily.

Supply of Gas in Bulk.—The Doncaster Corporation Gas Committee have agreed to furnish a supply of gas in bulk, at the current price, subject to discount for quantity, and subject to charges for any boosting required, as a result of an application from the Thorne Gas Light and Coke Company, Ltd.

Reduction in Price at Devizes.—Upon the recommendation of the Gas Committee, the Devizes Corporation have agreed to reduce the price of gas by 3d. per 1000 c.ft., as from April 1 last. The Gas Committee reported that the net profit, after paying all charges, was £1349, which was an increase of £821 on the previous year.

Address on Gas at Doncaster.—On April 30, Mr. Robert Watson, the Engineer and General Manager to the Doncaster Gas Department, gave an address on the "Gas Industry" before the Doncaster Rotary Club. In this he suggested that the proposition sometimes made of producing gas at collieries and distributing it throughout the country was not feasible, except in the local areas.

New Gas Department Workshops at Leeds.—At a meeting of the Leeds City Council on May 2, considerable opposition was expressed to the scheme to construct new Gas Department workshops, at a cost of £67,481. The objection was that the present state of the city's finances did not justify such a large expenditure. It was pointed out in reply that tenders for the work had already been accepted; and the amendment to the minutes was defeated, the meeting approving the resolution to borrow the necessary money.

Theft of Gas at Chesterfield.—At Chesterfield, Leslie Rowe, of Grassmoor, was accused of stealing £1 1s. 3d. from a gas meter, at his home, belonging to the Chesterfield Corporation. It was alleged that defendant opened the prepayment meter lock with a hairpin. The lock was partially broken, and damage of 2s. 6d. was claimed. The Deputy Town Clerk (Mr. S. Walker), in prosecuting, said cases of this description had been frequent in the Chesterfield district; and he urged that people should be taught to treat prepayment meters with respect. The Bench fined defendant £1, and ordered him to refund the money he had stolen and pay the amount of the damage.

Nunnery Coke and Gas Company.

The Nunnery Coke and Gas Company, Ltd., has been registered as a private Company, with a nominal capital of £50,000 in £1 shares. The objects are to acquire from the Nunnery Colliery Company, Ltd., the benefits and liabilities of the following contracts entered into by that Company so far as such contracts relate to and affect the Company: (1) An agreement dated March 28, 1927, with the Sheffield Gas Company for the supply of coke oven gas to that Company for twelve years or longer on the terms and conditions therein contained, and (2) an agreement dated Jan. 26, 1928, with the Woodall-Duckham Vertical Retort and Oven Construction Company (1920), Ltd., being a contract for the erection by that Company of coke ovens and other works for the supply of gas; to manufacture, sell, and supply gas in Sheffield and elsewhere; to carry on the business of a gas-works company in all its branches; to deal with, manufacture, and render saleable coke, coal tar, pitch, asphaltum, ammoniacal liquor, and other residual products obtained in the manufacture of gas, &c. During the continuance of the agreement dated March 28, 1927, the Sheffield Gas Company have power to nominate one Director. The Directors have power to create and issue to the Woodall-Duckham Vertical Retort and Oven Construction Company (1920), Ltd., the debenture provided for in the agreement dated Jan. 26, 1928, with that Company; and while such debenture is in force, the holder thereof has power to nominate a Director. The remaining Directors are to be nominated by the Nunnery Colliery Company, Ltd.

Gas Charges at Newcastle-under-Lyme.—The price of gas in Newcastle-under-Lyme has been reduced by 2d. per 1000 c.ft. From June 30 next the charges will be as follows: Ordinary meters, 3s. 7d.; industrial purposes, 3s. 3d.; power purposes, 2s. 10d.; sewage works, 2s. 10d.; all less 3d. discount.

Uxbridge Capital Issue.—On the opening of the tenders for the £50,000 of 5 p.ct. perpetual debenture stock which Messrs. A. & W. Richards offered on behalf of the Directors of the Uxbridge, Maidenhead, Wycombe, and District Gas Company, it was found that the issue had been largely over-subscribed, at prices ranging from £98 down to the minimum of £94 per £100 of stock.

Gas-Works Threatened at Maryport.—Owing to the "creeping" of a grassy earth-covered cliff at Sea Brows, Maryport, Cumberland, the local gas-works, built at its foot, are threatened. A land-slide is feared. Confronted with a situation calling for immediate action, the Council have rejected a tender from a Glasgow firm for a mass concrete wall for £2400, and accepted a local tender for a less complete scheme for £1025. Major Irwin, Chairman of the Gas Committee, told the Council that, acting on the advice of the Town Surveyor and the Gas Engineer, he declined to take any responsibility for the adopted scheme, and pointed out that a large stone crashing into a gasholder might lead to a serious situation.

Gas Exhibition at Wetherby.—The Harrogate Gas Company, who have taken over the undertakings of the former gas companies of Wetherby, Boston Spa, and Tadcaster, have completed the supply main from Harrogate to Wetherby; and that district is now using Harrogate gas. An exhibition of lighting, cooking, heating, and other gas appliances, especially for the home, is now being held at the Town Hall, Wetherby, promoted by the Harrogate Gas Company. It is a very attractive show. The Harrogate Company took over the old undertaking as from Jan. 1 this year, and the Harrogate gas was turned on to Wetherby on May 7 by Alderman F. Barber, Chairman of Directors of the Company. The exhibition was opened during the past week-end. Lectures and demonstrations in gas cookery are being given daily.

Fire at a Tar Distillery.—As a result of a fire on May 4 at the tar distillery of Messrs. J. E. C. Lord, of Bootle, two men named Stevens and Reid lost their lives. The men were cleaning out a tar cooler, one of a row of six. The other five were in use, and the men were inside the disused cooler, which is a long cylindrical boiler, entrance to which is made through a manhole. About 9 a.m. other workers in the yard heard a loud explosion, and on rushing to the scene found the row of coolers enveloped in flames and smoke. Efforts to get to the men were frustrated by the fierceness of the flames. When the Bootle Fire Brigade arrived, the place was a mass of flames and difficult to approach, on account of the streams of molten tar which flowed across the yard. After an hour's work the fire was extinguished, but the bodies of the men could not be got out, as it was not considered wise to attempt to open the boiler.

Neglect Causes Gas Explosion.—An explosion occurred on May 5 at a Chinese laundry in Sheffield. Wong Chung, who carries on the laundry business at 175, Ecclesall Road, detected a leakage of gas. He temporarily stopped the escape by closing the aperture with soap. Later he went to Liverpool, and left his assistant, Wong Yee, in charge of the premises. It seems that, though the pipe had been sealed at the front, gas continued to escape at the back of the pipe, and made its way through the plaster and joists into the wall. Wong Yee noticed that the smell of gas was becoming stronger, and decided at 6.30 p.m. to turn off the supply at the meter. When he reached the top of the cellar, it is stated that he struck a match to light the way. An explosion followed; and when the man recovered his senses, he was on the floor some distance from the cellar, and was suffering from burns. Two people who were passing the laundry were thrown from the pavement into the road, and were cut by splinters of glass. The Sheffield Gas Company have pointed out to consumers that it is extremely dangerous to leave a suspected escape unattended. They emphasize that the proper course is to notify the Company. Particularly do they warn consumers against the extremely foolish practice of looking for an escape of gas with a light. Inexpert methods of dealing with a gas leakage, such as stoppage by soap, cannot be too strongly condemned.

STOCK MARKET REPORT.

THERE was no material change in the character of the business on the Stock Exchange last week. The speculative sections continued to monopolize attention, and there were animated dealings in Industrials. Oil and Mining shares also made a bold showing. No benefit was derived in the gilt-edged market in the absence of a rise in the New York rediscount rate, and if anything the market was a little dull.

Business in the Gas Market was quite substantial; but in the absence of sellers, quotations of some of the stocks continue to be below their true market value. Aldershot 5 p.ct. maximum was marked up 2 points to 72-77, and one transaction was recorded at 74½. At this price the yield is £6 14s. 3d. p.ct., which, having regard to the class of the security, is a very high return. Croydon sliding-scale rose 4 points, and, at the average quotation of 110½, yields £6 6s. 8d. on a 7 p.ct. dividend; but the authorized rate for the current half-year is no less than £8 12s. 6d. p.ct., so there is a reasonable prospect of an improvement. Imperial Continental capital stock moved up again, but transactions took place at the lowest rate at the end of the week.

Issue.	Shares.	When ex-Dividend.	Dividends. Prev. Hf.Yr	Dividends. Last Hf. Yr.	NAME	Quotations. May 11.	Rise or Fall on Week.	Transaction Lowest and Highest Prices.
£			%p.a	% p.a.				
171,978	Stk.	Feb. 9	5	5	Aldershot 5 p.c. max. C. .	72—77	+2	74½
412,992	,,		4	4	Do. 4 p.c. Pref. . .	69—72	..	70
1,551,868	,,	Apl. 12	7	7	Alliance & Dublin Ord. .	93—96	..	95⅝—95¾
374,000	,,	Jan. 12	4	4	Do. 4 p.c. Deb. . .	64—67	..	..
522,654	,,	Mar. 8	7	7	Barnet Ord. 7 p.c. . . .	109—112	..	111½
300,000	1	Apl. 26	1/7½	1/7½	Bombay, Ltd.	21/—22/-	..	21/9—22/6
170,000	10	Mar. 8	8½	8½	Bournemouth 5 p.c. . . .	12½—13½	..	..
600,050	10	,,	7	7	Do. B 7 p.c. . . .	12—12½	..	..
275,000	10	,,	6	6	Do. Pref. 6 p.c. .	10½—11	..	11—11⅛
50,000	Stk.	Jan. 12	8	8	Do. 8 p.c. Deb. .	56—59	..	..
163,025	,,	,,	4	4	Do. 4 p.c. Deb. .	76—79	..	..
357,900	,,	Mar. 8	7⅛	7⅛	Brighton & Hove 6 p.c. Con.	115—118	..	..
341,880	,,	,,	6/8/6¾	6⅔	Do. 5 p.c. Con.	103—106	..	..
1,327,500	,,	Feb. 23	5	5	Bristol 5 p.c. max. . . .	87—88a	..	..
555,000	,,	Mar. 22	8	7	British Ord.	113—116	..	115—115½
100,000	,,	Dec. 22	7	7	Do. 7 p.c. Pref. . . .	114—117	..	..
130,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. .	73—76	..	76
200,000	,,	,,	—	33/2	Do. 5 p.c. Red. Deb. .	93—96	..	..
100,000	10	Nov. 24	8	6	Cape Town, Ltd. . . .	8—9	..	8⅞—9
100,000	10	Apl. 26	4½	4½	Do. 4½ p.c. Pref. . .	6½—7½	..	..
150,000	Stk.	Dec. 22	4½	4½	Do. 4½ p.c. Deb. . .	72—77	..	..
436,860	,,	Feb. 23	6	6	Cardiff Con. Ord. . . .	98—101	..	..
237,860	,,	Jan. 12	7½	7½	Do. 7½ p.c. Red. Deb. .	101—104	..	..
157,150	,,	Feb. 23	5	6½	Chester 5 p.c. Ord. . . .	87—92b	..	..
79,185	1	Apl. 26	†2/-	†2/-	Colombo Ltd. Ord. . . .	31/—33/-	..	..
24,495	1	,,	1/4½	1/4½	Do. 7 p.c. Pref. . .	20/—22/-	..	..
376,402	1	Apl. 12	1/9⅜	1/9⅜	Colonial Gas Assn. Ld. Ord.	23/—25/-	..	..
187,848	1	,,	1/7½	1/7½	Do. 8 p.c. Pref.	20/—22/-	..	..
3,073,280	Stk.	Feb. 23	5	7	Commercial Ord.	98—101	..	99⅜
475,000	,,	Dec. 22	8	8	Do 8 p.c. Deb. . .	58—61	..	59½
800,000	,,	Sept. 29	‡1	‡1	Continental Union, Ltd. .	32—37	+2	34—35
200,000	,,	Mar. 8	7	7	Do. 7 p.c. Pref. . .	88—93	..	..
727,560	,,	Mar. 8	6½	7	Croydon sliding scale . .	108—113	+4	110½—111½
408,100	,,	,,	5	5	Do. max. div. . . .	81—84	..	84
492,370	,,	Mar. 8	7	10	Derby Con.	110—115e	..	..
55,000	,,	Dec. 22	4	4	Do. Deb.	71—73e	..	..
209,000	,,	Mar. 8	5	5	East Hull Ord. 5 p.c. . .	76—79	..	..
50,000	,,	Dec. 22	5	5	Eastbourne 5 p.c. Deb. .	90—95	..	..
1,002,180	10	Mar. 22	†4	†6	European, Ltd.	8 - 9	..	8⅛—8½
18,708,480	Stk.	Feb. 9	5	5/1/4	Gas Light & Coke 4 p.c. Ord.	18/9—19/3f	..	18/9—19/1½
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max. . . .	63—65	..	64½
4,157,020	,,	,,	4	4	Do. 4 p.c. Con. Pref. .	77—80	..	78½—79½
5,602,630	,,	Dec. 22	3	3	Do. 3 p.c. Con. Deb. .	60—62	..	61—61½
181,815	,,	,,	6	6	Do. 6 p.c. Br'tf'd Rd. Db.	102—105	..	..
1,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. .	99—101	..	..
43,000	,,	—	7½	7½	Do. 7½ p.c. Ilford Deb. .	..	..	..
82,500	,,	Mar. 8	6½	6½	Hastings & St L. 5 p.c. Conv	87—90	..	..
918,740	,,	,,	5½	5½	Do. 5 p.c. Conv. . .	68—71	..	..
70,000	10	Apl. 26	†10	†10	Hongkong & China, Ltd. .	13½—14½	..	14—14½
178,200	Stk.	Mar. 8	5	5	Hornsey Con. 3½ p.c. . .	78—81	..	..
1,976,000	,,	Nov. 10	10	10	Imperial Continental Cap.	172—177	+5	169—177
228,130	,,	Feb. 9	8½	8½	Do. 8½ p.c. Red. Deb.	68—70	..	..
336,342	,,	Mar. 8	7	7	Lea Bridge 6 p.c. Ord. . .	94—97	..	..
2,145,907	,,	Feb. 23	5½	5½	Liverpool 5 p.c. Ord. . .	88½—89½b	+½	..
600,000	,,	Mar. 22	7	7	Do. 7 p.c. Red. Pref.	101½—102½b	..	..
165,736	,,	Feb. 23	9	8	Maidstone 5 p.c. Cap. . .	109—112	..	..
75,000	5	Dec. 22	†7	†8	Malta & Mediterranean .	5½—6	..	..
541,930	Stk.	Nov. 24	†7	†5	Montevideo, Ltd. . . .	92½—94½	..	..
2,061,815	,,	Mar. 8	5	5	Newcastle & Gateshead Con.	16/9—17/3d/f	..	..
960,939	,,	,,	4	4	Do. 4 p.c. Pref. . .	70½—71½d	+4	..
691,705	,,	June 29	8½	8½	Do. 8½ p.c. Deb. . .	66½—67½d	..	..
131,780	,,	Mar. 8	6/18/0	6/18/0	North Middlesex 6 p.c. Con.	97—100	..	98—99
300,000	,,	Apl. 26	9	7	Oriental, Ltd.	113—118	..	..
168,130	,,	Dec. 22	7⅞	7⅞	Plym'th & Ston'house 5 p.c.	102—107	..	..
414,500	,,	Feb. 23	7½	7½	Portsm'th Con. Stk. 4p.c. Std.	101—104	..	..
236,732	,,	,,	5	5	Do. 5 p.c. max.	77—80	..	..
2,334,464	1	—	—	—	Primitiva Ord.	25/—26/-	—2/-	25/—27/6
244,500	100	Dec. 1	4	4	Do. 4 p.c. Red. Deb. .	92—96	..	..
645,000	Stk.	Jan. 26	4	4	Do. 4 p.c. Red. Deb. 1911	76—78	..	..
416,845	,,	Dec. 22	4	4	Do. 4 p.c. Cons. Deb. . .	75—77	..	..
150,000	10	Mar. 22	6	6	San Paulo 6 p.c. Pref. . .	8½—8⅝	+⅛	8 7/16
128,000	50	Jan. 3	5	5	Do. 5 p.c. Red. Deb	46—48	..	..
970,000	Stk.	Mar. 22	6	6	Sheffield A	100—102e	..	..
419,968	,,	,,	6	6	Do. B	100—102e	..	..
1,047,000	,,	,,	6	6	Do. C	100—102e	..	..
90,000	10	May 26	4	6	South African	4—6	..	..
6,609,895	Stk.	Feb. 23	5	7½	South Met. Ord.	105—107	+1	105½—106½
500,000	,,	,,	—	6	Do. 6 p.c. Irred. Pf.	109—112	..	112
1,896,446	,,	Jan. 12	8	8	Do. 8 p.c. Deb. . .	59—62	..	60—60½
784,000	,,	Mar. 8	6½	6½	Do. 6½ p.c. Red. Db.	100—102	..	101—102
91,600	,,	Feb. 23	8½	8½	South Shields Con. . . .	112—114d	..	..
1,343,796	,,	Feb. 23	6½	6½	South Suburban Ord. 5 p.c.	105—108	..	107—107½
968,837	,,	Dec. 22	5	5	Do. 5 p.c. Deb.	95—98	..	98
647,740	,,	Mar. 22	5	5	South'mpton Ord. 5 p.c. max.	78—80	..	..
191,376	,,	Dec. 22	4	4	Do. 4 p.c. Deb.	72—75	..	..
350,000	,,	Mar. 8	7	7	Swansea 7 p.c. Red. Pref. .	100—103	..	102—103
200,000	,,	Dec. 22	6½	6½	Do. 6½ p.c. Red. Deb.	99—102	..	101½
120,000	,,	Feb. 23	7½	7½	Tottenham District A 5 p.c.	115—120	..	119
882,375	,,	,,	6¾	6¾	Do. B 6¾ p.c.	99—95	..	..
150,000	,,	,,	6½	6½	Do. 5½ p.c. Pref.	98—101	..	..
181,456	,,	Dec. 8	4	4	Do. 4 p.c. Deb.	74—77	..	..
					Uxbridge, Maidenhead, &			
289,094	,,	Mar. 8	6½	6 5/16	Wycombe 5 p.c. . . .	90—95	..	..
68,930	,,	,,	5	5	Do. 5 p.c. pref. . .	86—90	..	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	,,	Mar. 8	8½	8½	Wandsworth A 5 p.c. .	129—134	..	..
365,696	,,	,,	7	7	Do. B 8½ p.c. .	111—116	..	..
432,555	,,	,,	5/19/0	5/19/0	Do. C and New	98—103	..	..
852,090	,,	,,	6⅝	6⅝	Do. Wimbledon 5 p.c. .	106—111	..	109
98,000	,,	,,	7½	7½	Do. Epsom 5 p.c. . .	112—117	..	..
200,000	,,	,,	5	5	Do. 5 p.c. Pref . . .	86—91	..	..
85,116	,,	Dec. 22	3	3	Do. 3 p.c. Deb. . . .	57—60	..	59½
284,743	,,	,,	4	4	Do. 4 p.c. Deb. . . .	76—79	..	77½

Quotations at:—a.—Bristol. b.—Liverpool. c.—Nottingham. d.—Newcastle. e.—Sheffield. f.—The quotation is per £1 of Stock. * Ex. div. † Paid free of income-tax. ‡ For year.

The following transactions were recorded:

On Monday, Bombay 21s. 9d., Continental Union 34, 34½, 34⅜, 35, European 8½, Gas Light and Coke 18s. 9d., 18s. 11½d., 19s., 3½ p.ct. maximum 64½, Imperial Continental 169, Primitiva 26s. 6d., 26s. 9d., 26s. 10½d., 27s., 27s. 1½d., 27s. 3d., 27s. 4½d., 27s. 6d., San Paulo 6 p.ct. preference 8 7/16, South Metropolitan 105¼, 106, 6 p.ct. preference 112, 3 p.ct. debenture 60, 60½, 6½ p.ct. debenture 101, 102, South Suburban 5 p.ct. 107, 5 p.ct. debenture 98, Swansea 6½ p.ct. debenture 101½, Tottenham "A" 119, Wandsworth, Wimbledon 5 p.ct. stock 109. Supplementary prices, Barnet 4 p.ct. debenture 75½, Cheltenham 5 p.ct. maximum 75¾, Kingston-upon-Thames 102½.

On Tuesday, Alliance and Dublin 95⅝, Barnet 7 p.ct. maximum 111½, Bombay 21s. 9d., 22s. 3d., British 115¼, Commercial 99¾, Croydon 111½, Gas Light and Coke 18s. 9d., 18s. 10½d., 19s., 19s. 1½d., 4 p.ct. preference 78¾, 3 p.ct. debenture 61, Imperial Continental 170, 171, 172, Primitiva 26s. 9d., 26s. 10½d., 27s., 27s. 1½d., South Metropolitan 105¼, 106¼, 6½ p.ct. debenture 101, 102, South Suburban 5 p.ct. 107½. Supplementary prices, Croydon 6 p.ct. debenture 102, Kingston-upon-Thames 103, Metropolitan (Melbourne) 9⅛, Wandsworth 5 p.ct. debenture 100.

On Wednesday, Bournemouth 6 p.ct. preference 11, 11⅛, Cambridge University and Town 5 p.ct. debenture 95, Commercial 3 p.ct. debenture 59½, Continental Union 35, Croydon sliding-scale 111, 111½, European 8 1/16, Gas Light and Coke 18s. 9d., 18s. 10½d., 19s., 19s. 0⅝d., 19s. 1½d., 3 p.ct. debenture 61½, Imperial Continental 170, 171, 172, North Middlesex 6 p.ct. 98, Primitiva 26s. 6d., 26s. 7½d., 26s. 9d., 26s. 10½d., 27s., South Metropolitan 105½, 105⅝, 106, 106¼, 6½ p.ct. debenture 102, Tuscan 20s. Supplementary prices, Wandsworth 5 p.ct. debenture 100¾.

On Thursday, Aldershot 74½, Alliance and Dublin 95¾, Bombay 22s., 22s. 3d., 22s. 6d., Bristol 5 p.ct. maximum 86½, 87, British 115, 4 p.ct. debenture 76, Cape Town 8¾, Croydon sliding-scale 110½, Gas Light and Coke 18s. 9d., 18s. 9⅜d., 18s. 10½d., 18s. 11½d., 19s., 19s. 0⅜d., 4 p.ct. preference 78½, 79½, Hong Kong and China 14, 14½, Imperial Continental 170½, 171½, North Middlesex 6 p.ct. 99, Primitiva 24s. 4½d., 25s. 6d., 25s. 9d., 26s., 26s. 1½d., 26s. 3d., 26s. 4½d., 26s. 6d., 26s. 7½d., 26s. 10½d., 26s. 11½d., 27s., South Metropolitan 105½, Wandsworth 3 p.ct. debenture 59½, 4 p.ct. debenture 77¾. Supplementary prices, Barnet 4 p.ct. debenture 78, Cheltenham 5 p.ct. 75½, Wandsworth 5 p.ct. debenture 100¾.

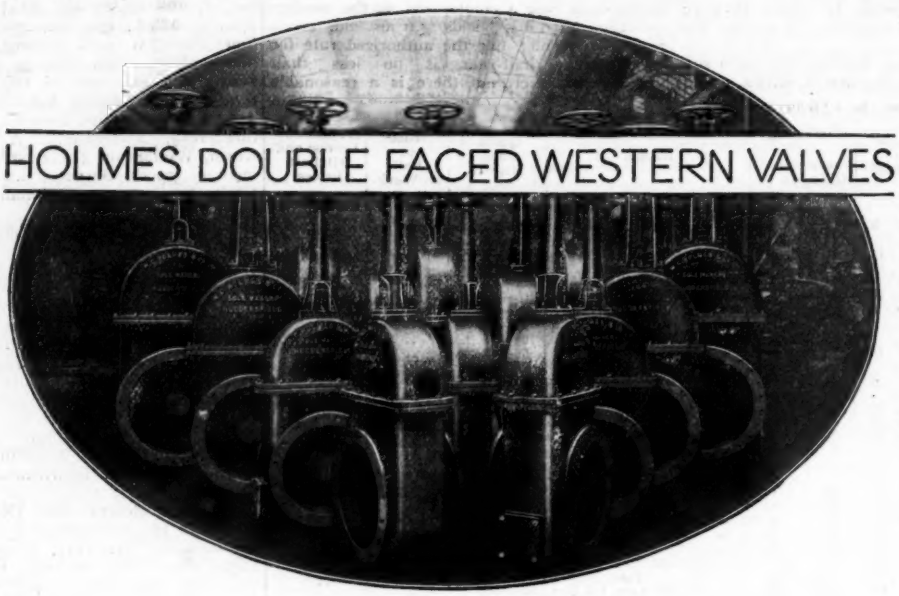
On Friday, Aldershot 4 p.ct. preference 70, British 115½, Cape Town and District 9, Croydon sliding-scale 111, maximum dividend 84, Gas Light and Coke 18s. 9d., 18s. 10½d., 19s., 19s. 0⅜d., Imperial Continental 170½, 174½, 176, 177, Primitiva 25s., 25s. 3d., 25s. 7½d., 25s. 9d., 26s., South Metropolitan 105½, 105⅝, 106, 106¼, 6½ p.ct. debenture 101½, Swansea 7 p.ct. preference 102, 103. Supplementary prices, Danish 8½, Wandsworth 5 p.ct. debenture 100¾.

In the Money Market, the usual easy week-end conditions prevailed. From the start money was available at 3½ p.ct., and the rate ultimately dropped to below 3 p.ct. for both old and new loans. Discount rates were also easier notwithstanding that Treasury Bills were allotted at a higher rate; the average being £3 18s. 9·42d. p.ct., as compared with £3 18s. 2·37d. for the previous week.

On the Foreign Exchange Market there was a sharp rise in the dollar-sterling, which closed at 4.88 3/32. Belgian currency was at one time offered freely, but after touching 34.96¾ recovered at the close to 34.95. Italian lire were slightly cheaper at 92.64½, and pesetas also at 29.02. French francs, despite the hardness of money in Paris, were steady at 124; but gold marks moved in favour of sterling at 20.40½.

Silver recovered on Chinese support, the price rising to 27½d. per oz.; while Gold was bought at 84s. 11½d. per oz., showing a slight decline.

The Bank Rate is 4½ p.ct., to which it was reduced from 5 p.ct. on April 21, 1927. The Banks' deposit rate is 2½ p.ct., and the deposit rates of the discount houses are 2½ p.ct. at call and 2¾ p.ct. at notice.



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